

MODERN MANAGEMENT

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BY

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FOREWORD BY

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NEW YORK

JOHN WILEY & SONS, INC.

LONDON: CHAPMAN & HALL, LIMITED

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THIRD PRINTING, JUNE, 1946

Printed in the U. S. A.

TO
DEXTER S. KIMBALL
DEAN OF MANAGEMENT ENGINEERING
EDUCATORS

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PREFACE

This book has been written in order to present the methods of modern management and the application of the scientific method to the various phases of that management. It is not a critical analysis of industrial methods. It endeavors to give the procedures which modern industrial and business managers are actually using in the management of their companies. For example, when it was found that a number of companies were applying the scientific method to most of their management problems the author decided that that procedure was essential and included it in this book. During personal visits to companies and in conferences with industrial executives, the author found a number of them defining modern management in the way in which it is defined in Chapter I, each arriving at his definition independently of the others. Periodically these executives would investigate the status of the various M's of management and improve those phases which needed improving. Because these managers defined their job of management and executed it in that scientific way, the author decided that the definition which these managers use was a fitting one to employ as the definition of modern management in this book.

This material is based upon: personal visits by the author to 42 industrial and business concerns, and information from 233 companies, principally through the cooperation of the National Industrial Conference Board of New York City, Cornell University, and Purdue University; the author's consulting work in industry and his business experience; his courses in industrial engineering and management, and personnel administration at Purdue University; and graduate study at Purdue and Cornell Universities.

The chapters in this book follow a titular sequence similar to the divisions of the definition of modern management. Each chapter represents one of the phases of management: Methods, Money, Men, Materials, Manufacturing, Marketing, and Measurement.

ACKNOWLEDGMENTS

The author is extremely grateful to Dexter S. Kimball, Dean of Engineering, Cornell University, for the constant encouragement and help in studying the management methods of the 233 companies. To Professor John R. Bangs, Director of Personnel, the College of Engineering, Cornell University, are due special thanks for his suggestions and advice. This book might not have been possible had it not been for the collaboration of the National Industrial Conference Board in making a survey of the personnel and other phases of management included here and the help in securing the entree of the author to the companies. He is especially indebted to Virgil Jordan, President, for writing the Foreword, which gives the typical viewpoint of management toward industry, and to Mr. H. F. Browne, Manager, Department of Industrial Management, of the National Industrial Conference Board, for his cooperation.

Special acknowledgments are due to President Edward C. Elliott and Dean A. A. Potter of Purdue University for making possible, through the granting of a leave of absence, the study of industrial concerns. Much appreciation is acknowledged to the following concerns for permission to visit their companies, for the hospitality shown by them, and for the information and material which they gave: L. S. Ayres & Company, the Diamond Chain and Manufacturing Company, the Utilities Service, the Indiana Bell Telephone Company, the Delco-Remy Corporation, the Studebaker Corporation, the General Electric Company (Fort Wayne, Indiana), the Goodyear Tire and Rubber Company, the Eastman Kodak Company, the Morse Chain Company, L. C. Smith & Corona Typewriters, Inc., the Bausch & Lomb Optical Company, the Gleason Works, the General Railway Signal Company, the Rochester Gas and Electric Corporation, the Stromberg-Carlson Company, the Taylor Instrument Company, the Empire Gas and Electric Company, Goulds Pumps, the Crouse-Hinds Company, the H. H. Franklin Company, the Onondaga Pottery Company, the Corning Glass Works, the Endicott-Johnson Company, the International Busi-

ness Machines Corporation, the Associated Gas and Electric System, the Shell Petroleum Corporation, the Emerson Electric & Mfg. Company, Purina Mills, Busch-Sulzer Brothers, the Heine Boiler Company, the Mallinckrodt Chemical Company, the McQuay-Norris Manufacturing Company, the Century Electric Company, the American Creosoting Company, the Louisville Gas & Electric Company, the Mengel Body Company, the Henry Vogt Machine Company, the Reynolds Metals Company, the Logan Company, and others. Also the author is indebted to the 233 companies who sent information to the National Industrial Conference Board and to the author as a result of questionnaires and letters.

Gratitude is due to Dr. Lillian M. Gilbreth for reading the part of the manuscript on time and motion study and for making suggestions; to Professors G. A. Young and G. H. Shepard for their encouragement and suggestions on teaching modern management at Purdue University; to LaMoin C. Hull, James T. York, and Jay H. Calvert for assistance in the editing and preparation of the manuscript; to Mr. R. B. Stewart, Mr. W. A. Bodden, and Mr. H. B. Abbett of Purdue University for their lectures and for the material in certain parts of this book; to Mr. Albert Ramond for the information on the Bedaux System; and to Miss Muriel Collins, Miss Mary Lucile Hazlett, and Miss Pauline Sheetz for their assistance in the preparation of the manuscript for publication.

J. E. WALTERS

LaFAYETTE, INDIANA

February 1, 1937

FOREWORD

That distinctive activity or function which we call management emerges more clearly year by year as the key creative element in the modern economic organization, under whatever political principle that organization operates. It is not yet easy to define sharply, either as a group of people or as a function, because management activities are much more widely diffused in the productive organization than is commonly supposed; but no one who understands the nature of the productive process today can doubt its intrinsic importance. Its effective application and development are as indispensable for economic and social progress under a communistic organization as under an enterprise organization—perhaps more so, since the latter tends naturally to foster and nourish it, while the former tends to minimize or short-circuit the management function in the effort to develop the state as a creative agency of economic welfare.

It is possible that in the course of economic and social evolution the next step will be the ultimate emergence of the state as a distinctive creative agency to which management will be subordinate; but we are a long way from this outcome, and it is clear from current experience that the evolutionary process cannot safely be speeded or short-circuited. This is still pre-eminently the age of management; we have, in fact, only entered upon this stage of evolution. Management has only begun to be conscious of itself, of its functions, and its responsibilities. The steady and rapid spread of the scientific approach to the problems of management, as younger men have come into the field of management responsibility, the development of professional organization and technical literature, and such systematic expositions of practice as the present volume, are clear indications that the management function, if not increasingly short-circuited by political forces, faces forward to a long period of fruitful growth.

Three facts stand out when the future field of business management is considered. First, we have definitely outgrown the agricultural economy which until recently so strongly influenced

our institutions and our attitude toward broader economic problems. We have become irrevocably industrialized. Second, our industrial progress has been so rapid, and demands for volume production have been so insistent, that insufficient care and thought have been given to developing an administrative technique comprehensive but flexible enough to meet all conditions. And third, because of errors of execution and maladjustments resulting from unbalanced growth, our whole system is vulnerable to attack by those who, vociferously stressing the shortcomings and disingenuously silent about the outstanding accomplishments of our enterprise system, would substitute some form of compulsory collectivist control.

The record of American industrial management is a record of achievement. Initiative, willingness to take great risks, and indomitable determination to overcome obstacles have characterized the progress of this country from a position of comparative insignificance among the industrial nations to one of leadership. These qualities were essential in a period of development from pioneer beginnings.

They still are indispensable, but now additional attributes are called for. The gains that have been made must be consolidated, operating technique must be adjusted to conditions which now prevail, management must be open-minded and responsive to changes which it is called on to meet. It must become familiar with a constantly wider range of knowledge concerning external economic, social, and political factors and influences affecting its problems. Adaptability and willingness to appropriate the best that modern management technique and economic research can offer characterize the alert executive of today.

To study the technique, the problems, and the possibilities of modern management is to study the key to the economic future of this country.

VIRGIL JORDAN

MODERN MANAGEMENT

CHAPTER I

THE MEANING OF MODERN MANAGEMENT

Change is always taking place in industry. What is commonly manufactured today may be obsolete or not used tomorrow. We go from the old to the new. The key to industrial well-being in one period may be different from that of another. In the yesterdays, buggies and wagons, heating stoves, phonographs, oil lamps, and silent motion pictures were made; today, automobiles, furnaces, electric lights, radios, and talking motion pictures are manufactured; airplanes, air-conditioning equipment, television, prefabricated houses, and technicolor "talkies" are being brought to pass; and tomorrow we may have stratosphere rockets and three-dimensional technicolored television.

Similarly, emphasis upon industrial functions changes. In the latter half of the last century, production opened the door of industrial well-being. What industry produced, it could usually sell—it had a sellers' market. In the present, our men and machines can produce an abundance of the world's goods—by mass production. Some call it over-production, others under-consumption. Industry now tends to produce what it can sell—a buyers' market. Distribution has become more complex. Mass manufacturing and marketing have brought mass management. In the future, the functional emphasis in industry may be upon service—service on the product and service to the people as consumers and workers.

Competition has become keener along with a tendency toward governmental regulation of industry as exemplified by the National Labor Relations Act, the Social Security Act, and especially the National Industrial Recovery Act, whose shadow still remains, even though it was declared unconstitutional. Although the NRA endeavored to abolish child labor and to establish maximum hours of labor, minimum rates of pay, fair trade prac-

tices, and the right of employees to organize, choose their own representatives, and bargain collectively, no restrictions were placed upon the output per worker, the adoption of more efficient methods of management and work, planning, or the design and development of new products. Many ask today for a planned economy, and we might at least expect closer governmental regulation or cooperation. Whether competition becomes keener, or governmental regulation becomes stricter, industry will have to produce and distribute goods and services at less cost in order to make a profit. Modern industrial management finds itself faced, generally as well as specifically, with more and more complex and difficult problems from the beginning of production to the end of distribution. How shall they be solved? The search for their answers is the new frontier in industry.

The application of science and the scientific method to industry seems to be the new frontier of modern management. Formerly, management was qualitative, but now it is quantitative as well. It was formerly an art; now it is becoming a science, with cost measured in dollars, tolerances to ten-thousandths of an inch, ratios and efficiency in percentages, work in minutes of human energy, and individual motions and operations in thousandths of a second. Management is measuring its achievement. Though its goals may be the employment of workers and the increase of human happiness, its effectiveness is still considered as being measured by its profits. The application of science and scientific methods, the increase of human happiness in industry, and a decrease in prices¹ may not be incompatible with profits. Price, today, may be set by competition (or regulation), but one of the ways to make a profit is to apply scientific methods to management and other problems.

¹ See H. G. Moulton, *Income and Economic Progress* (Washington, D. C.: Brookings Institution, 1935), for an excellent discussion of prices.

Also with reference to prices and the whole matter of production, Henry Ford has said: "The only formula for providing prosperity is, through the aid of science, to produce the largest possible amount of goods with the least possible amount of human labor, marking each lowering of the cost of production by an increase of wages and a decrease in selling price. If this principle be carried through distribution and service, real wages will constantly rise and the amount of goods called for will employ every human being who needs employment. And sufficient wealth in usable things will be created to supply all needs. That is the only way it can come." From an interview with Henry Ford by Samuel Crowther, "The Only Real Security," *Saturday Evening Post*, Feb. 1, 1936, p. 58.

THE SCIENTIFIC METHOD

The scientific method involves:

1. A clear statement of the problem.
2. The collection of data and facts previously discovered about the problem, and the recording of them in usable form.
 - (a) Reading books, technical bulletins, journals, etc., on what has been found in the past about the problem.
3. The observation, collection, and recording of all possible present facts relating to the problem and its solution.
 - (a) Personal visits, interviews, and correspondence with organizations and persons who have had experience with similar problems.
 - (b) Developing of the various possibilities of solving the problem.
4. The analysis and classification of present and past facts. Comparison of advantages and disadvantages of the facts.
5. The deduction of principles and laws derived from the facts, the application of the deductions to develop new results and facts, and the formulation of a logical solution based upon those facts.
6. The test and retest of the solution by repetition of the investigation, and the use and reuse of the solution so long as its value proves to be correct and adequate.

Good sound judgment in industrial management involves these processes. Real reasoning is difficult without them. It is relatively easy to guess, but troublesome and difficult to find out and know the facts. The modern manager's personal opinions, prejudices, and emotions may lead him astray; the application of scientific methods plus his personal opinion *may not*. "May not" was used instead of "cannot" because it must be recognized that the manager has to deal with men, and that men are feeling people as well as thinking people, and that they must be managed with a recognition of feelings as well as facts. It is necessary to consider both feelings and facts, and to develop an ideal of faith and facts.

The scientific method may also be stated as: (1) the analysis of the different parts of the problem, breaking it into its different elements; and (2) synthesis—the study of each element, the synthesis of those elements into a new solution, and the use of the best proved elements.

A manufacturing concern in the Middle West solves its management problems by the following steps centered around a major statement of the project:

Analyze	(Study)
Plan	(Design)

Direct	(Manage)
Do	(Produce)
Assemble	(Sell)
Dress up	(Tell)
Equip	(Supply)
Review	(Counsel)
Figure	(Calculate)
Report	(Mop up)

The complete managerial set-up is based upon the philosophy of following through this cycle of thought in solving any management problem.

✓ Modern management must be humanistic, materialistic, and scientific in order to profit under strict competition or regulation. It must not only select, control, and dispose of methods, money, men, material, machinery, manufacturing, marketing, and measurement, but it must deal with these means scientifically. However, the most scientific may be the most humanistic and materialistic as well as the most business-like and profitable. The task is large and difficult, but modern management is expected to do the largest and most difficult of tasks.

DEFINITION OF MODERN MANAGEMENT

✓ Modern management may be defined as the *scientific selection, control, and disposition* of METHODS, MONEY, MEN, MATERIALS, MACHINERY, MAINTENANCE, MANUFACTURING, MARKETING, and MEASUREMENT.

The application of scientific methods to these M's of management involves:

I. METHODS.

- Policies and Principles.
- Organization.
- Job Description, Evaluation, and Classification.
- Time and Motion Economy.
- Simplification, Standardization, and System.

II. MONEY.

- Ownership.
- Financing.
- General Accounting.
- Cost Accounting.
- Wage Incentives.
- Profits.

III. MEN.

- Personnel Management.
- Employment.
- Employee-Employer Dealings.
- Personnel Maintenance.
- Training and Education.
- Medical and Health Service.
- Safety and Accident Prevention.
- Personnel Service Work.

IV. MATERIALS, MACHINERY, AND MAINTENANCE.

- Plant Location and Layout.
- Purchasing.
- Material Handling.
- Stores.
- Machinery and Equipment.
- Lighting.
- Power, Heating, and Air-conditioning.
- Maintenance.
- Waste.

V. MANUFACTURING (Production Control).

- Issuing of Orders.
- Planning and Engineering.
- Routing.
- Scheduling.
- Dispatching.
- Inspection.

VI. MARKETING.

- Market Analysis.
- Selling the Product.
- Advertising, Publicity, and Public Relations.

VII. MEASUREMENT.

- Research.
- Profits and Budgets.
- Performance Ratios, Percentages, and Charts.
- Social Service.

From this outline it can be seen that modern management deals with numerous and varied problems which run the gamut of the M's of management. Although these problems of management are numerous, the scientific method can be applied to them.

If a manager had the problem of deciding upon the proper organization for his company, the application of the scientific method to that management problem would involve a clear state-

ment of the problem of defining an organization, the collection of facts about the company's present and past organization and about similar and dissimilar organizations in companies manufacturing the same and related products, a study of the books on this phase of management, talks with other managers, and the various other procedures of obtaining all the facts about organizations in that particular industry. After these facts were collected, they could be classified according to companies, products, types, etc. A description of each job and even a time study of each operation could be made. By using all these facts and their classifications, that manager would come to a sounder decision on the problem of organization than he could without the facts.

Although some people consider the application of the scientific method to human problems extremely difficult, if not impossible, yet it can be applied to those problems as well. For example, in the problem of the selection of the proper person from a group of persons for a particular job, the scientific method can be applied. The manager could first make, or have made, a clear statement of the problem and the job (job description) for which he is selecting. Second, he could collect facts about the various persons comprising the group available: facts about their intelligence by means of intelligence tests; their knowledge by means of trade tests and examinations; their education from their application blanks and references; the condition of their health from physical examinations; their character from ratings and references; their habits from references; their personality from ratings, references, and interviews; their ability to do the job from trade tests, application blanks, references, etc. After these facts about each applicant had been collected, they could be classified according to the advantages and disadvantages of each person's qualities for doing the work. Then if the solution of the problem, that is, the selection of the proper person, were based upon those facts, it is more likely that a better selection would result than if selection were based only upon a personal interview, or from personal acquaintance without such detailed facts.

Again, in the marketing field, if a person has the problem of marketing a new product, the scientific method could apply similarly. The manager would again collect facts about the product before it was put into production. He would analyze the

market with respect to that particular product, collecting facts from a representative sampling of people as to their needs and desires for, and the probable sale of, that product. After the collecting of facts from such marketing analysis and survey, the manager would classify his facts and have a better basis for solving the problem of the production than if he were guided only by his own personal opinion.

Applications of the scientific method such as these can be made to the various problems of management, if only managers would take the time and thought and make the effort.

THE MAKERS OF MODERN MANAGEMENT

Modern management is the result of the scientific management movement which has developed during the last sixty years largely from the work of Frederick W. Taylor,¹ the father of scientific management, and through the efforts of other makers of modern management—Henry L. Gantt,² Frank B.³ and Lillian M. Gilbreth, Harrington Emerson, Carl G. L. Barth, and others.⁴

The work of Frederick W. Taylor (1856-1915) gave the greatest impetus to scientific management. While preparing for Harvard at the Phillips Exeter Academy his eyesight became impaired. This difficulty caused him to leave school and enter the employ of the Midvale Steel Company in Philadelphia in 1878. He was successively and successfully gang boss, assistant foreman, foreman of the machine shop, master mechanic, chief draftsman, and chief engineer, to 1889. While working at the Midvale Steel Company he carried on his engineering education at the Stevens Institute of Technology without attending classes. Although the effort of combining his technical studies with employment was strenuous, he graduated in 1883. After he left the Midvale Steel Company he began the work of organizing the management of manufacturing establishments of

¹ F. B. Copley. *Frederick W. Taylor, The Father of Scientific Management*. New York: Harper & Brothers, 1923. Vols. I and II.

² L. P. Alford. *Henry Laurence Gantt, Leader in Industry*. New York: American Society of Mechanical Engineers. (Harper & Brothers), 1934.

³ Lillian M. Gilbreth. *The Quest of the One Best Way—A Sketch of the Life of Frank Bunker Gilbreth*. New York: The Society of Industrial Engineers.

⁴ In recent years such men as Dexter S. Kimball (*Principles of Industrial Organization*), L. P. Alford (*Management's Handbook, Cost and Production Handbook, and Laws of Management*), and H. S. Person have helped carry forward the management movement.

various kinds, which included the Bethlehem Steel Company and the William Cramp and Sons Ship and Engine Building Company.

In addition to his contributions in the field of management he received one hundred patents for various inventions, one of the more outstanding being the Taylor-White process of treating modern high-speed tool steel. He received the gold medal from the Paris Exposition in 1900 in recognition of this discovery.

When Taylor had accumulated a sufficient amount of money to provide for his private needs, he retired from active management work, and devoted himself to transmitting his management ideas to others through lectures at his home, demonstrations in industrial plants, and his writings. His principal publications in the management field were: *The Art of Cutting Metals*, 1906; *The Principles of Scientific Management*, 1911; *Shop Management*, 1911; and numerous articles in *Mechanical Engineering*, and the *Transactions* of the American Society of Mechanical Engineers, of which he was president in 1905-06.

By strenuous effort and through many difficulties in engineering and management in steel companies and other manufacturing plants he developed the first principles of scientific management, which he later stated as follows:

Scientific management in its essence, consists of a certain philosophy, which results in a combination of the four great underlying principles of management:

First. The development of true science.

Second. The scientific selection of workmen.

Third. Their scientific education and development.

Fourth. Intimate, friendly cooperation between the management and the man.¹

Although Taylor's chief contributions were the principles of scientific management, he made a number of specific management contributions, such as the Taylor differential piece rate system of wage payment,² time study,² method study, as well as his procedure for carrying on research.

After his death, Taylor's work in scientific management was promoted by the Society of Industrial Engineers and the Taylor Society, which combined into the present Society for the Ad-

¹F. W. Taylor. *The Principles of Scientific Management*. New York: Harper & Brothers, 1911. P. 130.

²See a description of the Taylor differential piece rate system in the section entitled "Wage Incentives" in Chapter IV, "Money," and his definition of time study in the section—"Time and Motion Study" in Chapter III, "Methods."

vancement of Management. The management section of the American Society of Mechanical Engineers and the American Management Association have aided nobly in carrying forward the management movement. Taylor's principles have withstood the test of time as being fundamentally sound, but, with the constant and rapid changes in industry, the Taylor Society considered that a restatement of the principles of scientific management would clarify them in the light of recent practice. H. S. Person, then Managing Director of the Taylor Society, restated the principles of scientific management in 1929 to meet these changing conditions, as follows:

1. *Management Research.* Research, investigation, and experiment (with their processes of analysis, measurement, comparison, etc.) constitute the only sound basis for the solution of managerial problems; for determinations of purpose, policy, program, project, product, material, machine, tool, type of ability or skill, method and other factors, and the coordination of these in purposeful effort.

2. *Management Standards.* To make them useful to an enterprise, the results of research, investigation, and experiment must be made available to the cooperating group in the form of defined and published standards which serve as common goals, facilities, and methods, and which replace chance and variable factors by constants in terms of which may be made calculations and plans which may be expected to come true.

3. *Management Control.* There must be established a systematic procedure, based on the defined standards, for the execution of work; a procedure which directs the researches, establishes and maintains the standards, initiates operations and controls work in process; which facilitates each specialized effort and coordinates all specialized efforts, to the end that the common objective may be achieved with a minimum of waste of human and material energies, and with a maximum of human welfare and contentment.

4. *Cooperation.* Durably effective management requires recognition of the natural laws of cooperation; involving the integration of individual interests and desires with group interests and desires and of individual capacities with the requirements of group purposes; the substitution of the laws of situations for individual authority, guess, and whim; and the recognition and capitalization of human differences, motives, desires, and capacities in the promotion of a common purpose.¹

Closely associated with Taylor in some of his management work was Henry Laurence Gantt (1861-1919), who was also one of the leaders in industrial management in his day.

After graduation from the Johns Hopkins University at the age of nineteen, Gantt studied at the Stevens Institute of Tech-

¹The Taylor Society. H. S. Person (Editor). *Scientific Management in American Industry*. New York: Harper & Brothers. 1929. Pp. 10-11.

nology, where he received his degree in mechanical engineering in 1884. He soon became associated with Frederick W. Taylor at the Midvale and Bethlehem Steel Companies, where he too rose rapidly in the fields of industrial engineering and management, to the extent that he established his own consulting practice as an industrial engineer. During the World War, Gantt acted in a consulting capacity for the Ordnance Department. His principal books were: *Work, Wages, and Profits: Their Influence on Cost of Living*; *Industrial Leadership* (Yale lectures); and *Organizing for Work*.

Gantt was one of the early industrial engineers to emphasize unlimited production for service to the community or country rather than for profit. He contended that such service is the foundation of all industry, and that any reward or profit that business arbitrarily takes over and above that to which it is justly entitled for service rendered is a menace to the permanent industrial peace of the world.

In 1919 he predicted an industrial crisis unless industry accepted its social responsibility and devoted itself primarily to service instead of profits; otherwise, the community would ultimately make the attempt to take it over in order to operate it in its own interests.¹ He suggested that the industrial engineer who studied industrial problems scientifically was the man to carry on unlimited production for service rather than for profits, primarily.

Mr. Gantt's chief contributions in the field of industrial engineering were:

1. Establishing of methods of distributing costs and expense. Mr. Gantt said, "The indirect expense chargeable to the output of a factory should bear the same ratio to the indirect expense necessary to run the factory at normal capacity, as the output in question bears to the normal output of the factory."² He emphasized that this plan was better than charging all overhead of the company in time of depression to the cost of the specific product or products being manufactured.

2. The calculation and charting of idleness expense, which showed the expense of idle machines and departments.

3. The setting of tasks for management.

4. Formulation of the Gantt man and machine record charts;³ layout and

¹ H. L. Gantt. *Organizing for Work*. New York: Harcourt, Brace & Howe. 1919. P. 15.

² H. L. Gantt. *Organizing for Work*. New York: Harcourt, Brace & Howe. 1919. P. 34.

³ Samples of Gantt charts are given in Chapter VII, "Manufacturing."

load charts; order record charts; bonus record charts; and other record and progress charts. These charts gave a comparison between what each man, machine, department, etc., produced and what should have been produced, and thereby their efficiencies and inefficiencies.

5. The use of the element of time as a basis or unit of work.

No description of the management movement and its development would be complete without a statement of the work and contributions to the field of management of Frank B. Gilbreth (1868-1924).

While preparing for college at the Boston schools he felt the urge of a business career upon being encouraged by a friend to enter the contracting business. After serving as an apprentice, he rose rapidly through supervisorship to be a manager. The next step was either to form a partnership or to enter business for himself. He chose the latter. In his own company he soon established a reputation for doing things which other contractors could not do, such as waterproofing cellars, speed work, cost plus a fixed sum, and various concrete and business systems. He applied time, motion, and fatigue study to work and prepared standard practice instructions, all of which led him to enter the management field, where he established management methods not only in construction companies, but also in various types of industrial plants. He also applied these methods to the production of supplies during the World War. After the Armistice he continued his work and established laboratories for research in management methods.

His contributions to the management movement were great. Among the most important were:

1. Motion Study. (a) The reduction of best practice to writing and the enumeration of the motions used and the variables which affect each motion; therbligs; and cyclegraphs. (b) The one best way of doing work.¹

2. Fatigue Study. The accurate determination of the causes of fatigue in performing various types of work, the elimination of all unnecessary fatigue, the reduction of the necessary fatigue to the lowest amount possible, the providing of all possible means of overcoming fatigue, and the recording of fatigue facts in such form that every worker can use them for himself to get more out of life.²

¹ F. B. Gilbreth, *Motion Study*. London: Constable & Co. 1911.

² F. B. and L. M. Gilbreth, *Fatigue Study*. New York: The Macmillan Co. 1919. P. 7.

3. **Micromotion Study.** The use of motion pictures in motion study.

4. The application of scientific management to industrial work, especially within the fields of motion study, waste elimination, handling materials, and management conditions; and the emphasis upon the human problems of management, such as, the Three Position Plan of Promotion, "fortune sheets," etc.

Although his wife, Dr. Lillian M. Gilbreth, was a constant partner in his work, ~~she~~ he has made distinct individual contributions to the field of industrial engineering, in addition to the ones on which she cooperated with her husband. Some of them are: The psychology of management,¹ the application of industrial engineering and motion study to the work of the home, and the teaching of micromotion study.

All these—Taylor, Gantt, and the Gilbreths—along with Harrington Emerson, Carl G. L. Barth, and the others have carried forward the management movement until today a company which does not apply science and the scientific method to its work may soon be left behind and will not be able to keep up with modern progress.

Industry has recently passed through a severe depression, and all costs have been scrutinized and cut. Some old methods have fallen by the wayside and new ones have been adopted until today the following differences between the old and new types of management stand out:

✓ OLD RULE-OF-THUMB, TRIAL- AND-ERROR MANAGEMENT	MODERN SCIENTIFIC MANAGEMENT
1. Decisions based upon personal opinions, prejudices, trial and error, and guesswork.	1. Decisions based upon facts, scientific knowledge, and a science of work.
2. Responsibility for knowledge of trade, methods of work, planning, and production rests with worker.	2. Management assumes responsibility for knowledge of work, methods, planning, and production.
3. Records left to memory of worker and foreman.	3. Accurate, definite, written records.
4. Amount of work and tasks set by worker.	4. Task and amount of work set by management—time and motion study, and job analyses.
5. Selection of workers on the basis of personal opinion only.	5. Scientific selection and training of workers.

¹ Lillian M. Gilbreth. *The Psychology of Management*. Sturgis & Walter Co. 1914.

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| 6. Low wages and low cost. | 6. High wages and low cost. |
| 7. Time and straight piecework wages. | 7. Incentive wages. |
| 8. Individualism. | 8. Cooperation. |
| 9. Restriction of output under voluntary production. | 9. Maximum output under increased production activities. |
| 10. Management drives workers. | 10. Management leads workers. |
| 11. Generalization of trades. | 11. Specialization of workers. |
| 12. Belief that workers' and management's interests are different. | 12. Belief that interests of workers and management are similar. |

For rating modern management, Mr. Charles Reitell¹ has devised the following scale. Each principle is rated from 0 for the firm with inferior management, 5 average, and 10 superior according to the methods listed. The excellence of the management is judged by the total score from 0 to 100, and 0 to 10 for each of the following ten divisions (place the rating in the blank rectangle after each division):

THE MANAGEMENT PRINCIPLES AND METHODS IN THE SUPERIOR FIRM

I. INFORMED LEADERSHIP.

1. Weekly or Monthly Reports from all Divisions—
Production, Sales, Executive, and Financial Showing:
 - (A) What Should Have Been Accomplished (Standards).
 - (B) Variances of Actual Performance from Standards.
2. Budgetary Control Over All Expenditures.
3. Forecasts Showing Future Trends.

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II. SOUND ORGANIZATION.

1. Organization Set-Up Clean-Cut and Definite.
 - (A) Fixed Responsibility.
 - (B) No Overlapping Authority.
 - (C) Complete Coordination among All Departments, Especially between Sales and Production.
2. Centralized Personnel Management.
3. Organization Chart Covering Both Personnel and Functions.
4. Development of Understudies for Executive Positions.

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III. BALANCED FINANCIAL STRUCTURE.

1. Adequate Liquid Investments to Meet Exigencies.
2. Funds Available for Making Advantageous Purchases and Taking Discounts.

¹ Charles Reitell, "How Good Is Your Management?" *Factory Management and Maintenance*. Vol. 93. No. 1. January, 1935. P. 12.

3. Current Ratios Including Inventory Controlled by Use of Budgets.
4. Financial Provisions for Replacing Depleted and Depreciated Assets.
5. Excess and Idle Capacity Carefully Measured.

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IV. PROPER MARKETING OF PRODUCT.

1. Complete Market Analysis Periodically Showing Actual vs. Potential Sales by Lines of Product, by Territories, and by Salesmen.
2. Sales Efforts Analyzed, Controlled, and Directed to Obtain Maximum Results from Effort Expended.
3. Sales Analyzed on Basis of Profit Realization.
4. Customer Service Made Important Function.

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V. EFFECTIVE PHYSICAL EQUIPMENT AND LAYOUT.

1. Modern Machinery Provided.
2. Layout Takes Advantage of Synchronized Progressive Line.
3. All Production on a Standard Time Basis.
4. Excellent Maintenance Provided, Keeping Equipment in Standard Condition.
5. Repairs Carefully Recorded and Standards Set.

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VI. SIMPLE, ADEQUATE RECORDS.

1. All Unnecessary Records Eliminated.
2. Records and Reports Meet Specific Needs of Those Who Use Them.
3. Modern Mechanical Bookkeeping and Statistical Methods Used.
4. Records and Timely Reports Covering Products and Performance.
5. Accounting and Costs Parallel Lines of Organization.
6. Proper and Adequate Filing.

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VII. THE DEVELOPMENT OF STANDARDS.

1. Standard Costs Wherein the Accounting System Portrays Required Performance Rather Than Merely Recording History.
2. Variances from Standard Reported Daily, Weekly, or Monthly.
3. Variances Subjected to Follow-up Program.
4. Overheads Controlled by Flexible Budgets with Definite Responsibility.
5. Constant Study and Revision of Standards.

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VIII. MEASURED INCENTIVES.

1. Direct Labor Controlled by Incentives Based upon Performance Standards.

2. Sales Incentives Provided for Sales Effort Covering Both Volume and Profit Realization.
3. Key-Man Bonus Established for All Supervisors.
4. Executive Compensation Plan for Top Executives.
5. All Bonuses Related to Superperformance and Specific Savings.

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IX. ADEQUATE RESEARCH.

1. Constant, Planned Research Covering:
 - (A) Merchandising Methods.
 - (B) Management in All Its Phases.
 - (C) Production.
 - (D) Design of Product.
 - (E) Possibility of New Lines and New Outlets for Old Lines.

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X. RELATION WITH YOUR INDUSTRY AS A WHOLE.

1. Takes Active Part in Trade Association for the Industry.
2. Helps Establish and Maintain Fair Trade Practices.
3. Assists in Building Uniform Accounting Records for the Whole Industry.
4. Helps in Building Balanced Program—Production with Consumer Demand.
5. Complete Cooperation with Code and Code Authority.

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SCORE	TOTAL	100	
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SPECIAL ASSIGNMENTS

1. Apply the scientific method to a personal problem such as getting a new job.
2. Apply the scientific method to some specific problem in industrial management.
3. Report on the specific management differences between an excellent company or department and a poor one.
4. Rate some company on the Reitell Rating Scale of Management, given in this chapter.
5. Study and report in detail on the biography and contributions to the field of management of: (a) Frederick W. Taylor; (b) Henry L. Gantt; (c) Carl G. L. Barth; (d) Frank B. and Lillian M. Gilbreth; (e) Harrington Emerson; (f) or others.

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CHAPTER II

HISTORICAL BACKGROUND OF INDUSTRY AND GOVERNMENTAL REGULATION

Modern management of industry has in recent years been passing through a period of increasing federal and state governmental regulation as evidenced by the National Industrial Recovery Act, the National Labor Relations Act, the Social Security Act, and various other *New Deal* and state legislation after 1933. This growing tendency to regulate industry may bring to the industrial and business manager of the future the necessity of participating more and more in what might be called the politics of governmental regulation of industry either from the viewpoint of cooperating with the regulatory administrations or that of securing the passage of regulations more favorable to industrial management. Because the industrial manager of tomorrow can expect to participate more in politics, it may be well to discuss the historical background of industry with emphasis upon the governmental regulation of industry and the viewpoints back of such trends.

The regulation of industry by the government, or the endeavor to regulate it, is almost as old as industry itself and exactly as old as industry's opposition to such regulation. Industry has always wanted to manage its own affairs without governmental interference.

Probably the first attempt at governmental regulation of industry was that of the Code of Hammurabi,¹ sixth king of Babylon, about 2250 B.C. This code of laws, among other things, regulated the wages of laborers and artisans (bricklayers, tailors, carpenters, masons, and others), the hire of boats, and the prices and practices with reference to slave labor.

The next great code that had considerable effect upon its own

¹ R. F. Harper. *Code of Hammurabi*. Chicago: The University of Chicago Press. 1904.

people as well as future generations was the Justinian Code¹ of the Roman Empire, which became a law in A.D. 529. The Emperor Justinian called together the legal authorities and other wise men of the country and asked them to prepare a book of laws, from which the Justinian Code resulted. It contained laws regulating both private and civil affairs, and is considered one of the most important forerunners of all codes, legal and otherwise.

Those early industrial and legal codes emphasize that the regulation of industry is not new. The *New Deal* has some old features, not only from Babylon and the Roman Empire, but also from England.

ENGLISH BACKGROUND²

Although the English industrial background and the governmental regulations of British industries have had an effect upon American industry, the development in England has varied considerably from that of America.

One of the first attempts at governmental regulation of industry in England was made in 1351 when the Statute of Laborers was enacted to force workers to accept employment. The great pestilence, the Black Death, of 1348 and 1349 caused the loss of about half of the population of England. Because the labor supply was diminished 50 per cent and because the workers were able to make a commutation of their formerly required services by the payment of money, many of them refused to work and others did not need to work all the time to provide for their modest private needs. The lords, faced with this labor shortage, began to enclose their small plots of land into larger ones so that fewer workers could attend larger flocks. By this Enclosure System the landlords were able to produce more wool to meet the rising demand for the English fabrics.

The increased demand for English wool encouraged merchant middlemen to distribute the wool to the workers' domestic establishments to be worked upon there by them. This started the

¹ F. Bernard. *The First Year of Roman Law*. The Oxford University Press. 1906.
J. B. Moyle. *Justinianus*. 1896.

² For a fuller description of the English industrial background see E. P. Cheney, *Industrial and Social History of England*, New York, Macmillan Co., 1912, 317 pp.; H. deB. Gibbins, *The Industrial History of England*, London, Methuen & Co., 1890, 232 pp.; and R. W. Cooke-Taylor, *The Factory System and the Factory Acts*, London, Methuen & Co., 1894, 184 pp.

domestic system of manufacture. As the skill required to manufacture textiles increased, craft and merchant guilds were established for the protection of the workers and the merchants. By 1500 these guilds had gained numerous powers in regulating industry, which led to the enactment in 1564 of the Statute of Apprentices making labor compulsory and establishing wages, hours, and conditions of work. Although it was not very effective, this statute remained on the books until 1813. The opposition of non-guild craftsmen and employers to the guilds increased until the Combination Acts were passed, which limited their activities.

From 1660 to 1860, the colonial, economic, commercial, and industrial expansion of England occurred. A great impetus in this expansion was the industrial revolution, which came as a result of inventions of the spinning jenny in 1765, the water frame in 1769, the "mule" jenny in 1779, the power loom in 1784, and the development of the first practical steam engine in 1785. Through these inventions skill was transferred to the machines. English manufacturers quickly introduced the machinery which was made possible by these inventions and which made it possible to employ less skilled help than formerly. The employment of women and children increased rapidly. Employers, intent upon production and profit, permitted working conditions to become so deplorable that a long series of Factory Acts were passed during the nineteenth century to correct them. These acts, although effective in improving some of the working conditions of the women and children, did not change greatly the status of men workers. The general industrial situation early in the nineteenth century led to the enactment of the Trades Board Acts¹ to improve working conditions. The first of these acts (1909) greatly resembled the National Industrial Recovery Act of this country. Since 1909 the Trades Boards Acts have been amended and reenacted, and constitute England's attempt at governmental regulation of industry today.

This brief statement of English background reveals, however, a long series of attempts to regulate industry by the government. British industry has had more experience with governmental regulation and in certain periods has needed it more than American industry. English industry even seems to thrive on it in many

¹ See Barbara N. Armstrong, *Insuring the Essentials* (New York: The Macmillan Co., 1932, pp. 48, etc.), for description of these acts.

instances. At least, management in the British Isles seems more tolerant of such regulation than that in America. Let us look at the historical background of American industry and try to find the reason for the viewpoints of management in the United States in respect to governmental regulations of industry.

AMERICAN BACKGROUND¹

Believing the world to be round, Columbus sailed due west from Spain in 1492. He expected to find a new trade route to the West Indies, but instead discovered America. Spain, France, Holland, and England, soon realizing that this new land was not the Indies, endeavored to enlarge their economic horizons by commerce with the American Colonies. Economic motives, a desire for religious freedom and political independence, and relief from regulation and taxation spurred the early settlers to found and colonize America.

Individualism, especially with reference to personal liberty, individual initiative, and free enterprise, have developed American industry. Instead of regulation of production in colonial days and in the earlier days of the United States, bounties were given in order to encourage individual initiative and free enterprise to greater production and accomplishment.

Virginia and Plymouth were colonized by chartered commercial companies, and land was given to the members. With so much land available, any tenure system was bound to fail. Agriculture became the predominant industry, with only one-tenth of the population of New England in non-agricultural pursuits.

Labor from the first was scarce; that available included free laborers, and indentured servants and slaves. If work became too difficult and management too severe, labor could leave and settle on the new frontiers. Labor was free to move. The continued scarcity and freedom of labor greatly hindered a more rapid industrial development.

Colonial industry consisted of lumbering, shipbuilding, the

¹ For detailed description of this background see the following:

(1) H. U. Faulkner. *American Economic History*. New York: Harper & Brothers. 1931.

(2) E. S. Cowdrick. *Industrial History of the United States*. New York: Ronald Press Co. 1923.

(3) "What Industry Means to America." *Factory Management and Maintenance*. August, 1936. Vol. 94. No. 8.

(4) P. H. Douglas, et al. *The Worker in Modern Economic Society*. The University of Chicago Press. 1925. Pp. 150-94.

manufacture of naval stores, fur trading, fishing and whaling, wool and cotton textile manufacturing, and mining and iron manufacturing. Their earliest beginnings can be seen from the following:

The first sawmill in New England was built prior to 1635; in Virginia in 1652.

The first important ship was built on the Manhattan River in 1614.

The first woolen and fulling mill was built in Rowley, Massachusetts, in 1643.

The first ironworks in Virginia was erected in 1619 at Falling Creek; the first in Massachusetts in 1643 near Lynn.

A brick kiln was set up at Salem, Massachusetts, in 1629; and the first brick house in Massachusetts was built in Boston in 1638.

A glass furnace was erected in Jamestown in 1609.

Any regulation of colonial industry that existed usually came from the mother European countries. Probably the first attempt at industrial regulation by the colonies was that of the General Court of Massachusetts,¹ which declared in 1641 that the building of ships was a business of great importance for the common good, and provided for the appointment of inspectors with authority to see that the work was carried on according to the rules of the trade. In 1655 this Court ordered selectmen to require each spinner to spin three pounds of linen, cotton, or woolen yarn each week for thirty weeks during the year. In 1667 it ordered a committee to draw up and present suitable laws for the regulation of shipbuilding.

Virginia and Connecticut passed laws requiring the planting of flax and hemp, and Connecticut required towns to purchase cotton in proportion to their population. These regulations were rare, but the giving of bounties and aids was more common. The trend of this early regulation of industry was usually to encourage production rather than tax or limit it. Bounties on hemp, flax, linen, textiles, and naval stores were given profusely in the seventeenth century. Also tracts of land were given to citizens for starting iron, fulling, and other mills, and in certain cases taxes on material for manufacturing were remitted. The

¹ H. U. Faulkner. *Op. cit.* P.84.

very nature of these bounties emphasized the fact that industry was mainly in the household stage with only slight trace of the modern factory system.

About the middle of the eighteenth century came the strict regulation and taxation of colonial commerce by England, which led to the Revolution—the first organized objection to strict regulation. Even before the Revolution the colonists tried to encourage manufacturing, especially of woollens and linens, during the boycotts of English goods. Several of the states made substantial loans to aid in the starting of manufacturing plants. Labor, already scarce, was made more so by enlistments in the army, and wages soon doubled. Nevertheless, the requirements for the war had to be met, and in the end colonial industry found itself stimulated. After the war, American manufacturing slackened, not only because of the competition of foreign goods and the loss of foreign markets, but also because of internal factors of politics, finance, tariff, commerce, scarcity of labor and capital, and the abundance of free land. As a matter of fact, this left much raw material in the colonies, and with the partial shutting off of foreign imports and an increase in immigration, the Colonists soon found ways and means to manufacture it.

During the latter half of the eighteenth century great inventions had been made in England, leading to the use of machinery generally. The manufacturers in America became interested, even though the emigration of skilled operatives and the exportation of machinery from England were prohibited by statute. In spite of this, factories using the spinning jenny were established in 1787 in Philadelphia and in Beverly, Massachusetts. In 1789 Samuel Slater, an English immigrant who had been an apprentice in one of Arkwright's factories in England, built the first successful Arkwright mill at Pawtucket, Rhode Island, where machine-made cotton warp was spun in 1790. American inventions did not contribute to industry at first, but in 1793 Eli Whitney invented the cotton gin, which from the beginning made it possible for one man to clean ten times as much cotton as he had been able to clean by hand. The steam engine was introduced in 1803 in a sawmill in New York. Robert Fulton applied it to water transportation in 1807 when he steered the *Clermont* up the Hudson River.

The use of machinery and the application of power spread rapidly, until by 1810 America found itself in the industrial revo-

lution, and the transfer of manufacture from the household to the factory became a strong tendency. The development of transportation came with the completion of the Erie Canal in 1825, the opening of the Baltimore and Ohio Railroad in 1830, and other canals and railroads about that time. Railroad construction increased from 32 miles in 1830 to 36,626 in 1860, and this cheaper and more rapid means of transportation spurred on industry in spite of the great western movement of the people in the first half of the nineteenth century.

Government regulation of industry was practically unknown before the Civil War, and unbridled freedom and competition reigned supreme. The *laissez-faire* doctrine was the guide.

With the introduction of machinery, the scarcity of labor was not felt so much by industry because women and children could be employed to run the machines. The pressing desire for profits caused employers to take advantage of this situation in many instances, and led to the exploiting of labor, especially of women and children. Long hours of work and unsanitary working conditions prevailed.

One of the first governmental or state investigations of these conditions of labor in industry was that of the committee of the Massachusetts Legislature in 1825, which reported a twelve- and thirteen-hour day for children in the Massachusetts factories,¹ and little opportunity for education. This resulted, however, in no serious consideration of regulating employment in that state, the let-alone policy, with reference to governmental control, being supreme.

With the panic of 1834 and the increase of immigration in the forties, competition of labor grew stronger, wages were reduced, and employment conditions grew worse. Although the first local craft union of the Philadelphia carpenters was started in 1791, and even though by 1836 there were 144 unions in Philadelphia, New York, Boston, and Baltimore, and the National Labor Union had been organized in 1806, these organizations and related ones had not gained enough strength and influence to change public opinion against the working conditions to the extent of any regulation.

The Civil War came, which stimulated manufacturing and the protective tariffs. Even the government manufactured war

¹ J. R. Commons, et al. *Documentary History of American Industrial Society*. Vol. V. P. 59.

implements and built ships. Inventions increased rapidly, and mining developed. The big jump in prices during the war without the same increase in wages caused many labor troubles. The large influx of immigrants increased the labor supply, but wages did not increase so rapidly as prices. Still industry was relatively free from regulation.

Although the industrial revolution made substantial progress in the first half of the nineteenth century, its real development came during the latter fifty years. While the population trebled from 1850 to 1900 the value of manufactures increased eleven-fold. Industry was given the utmost freedom of action, even to the extent that the railroads were given millions of acres of land. Many of the country's resources were freely appropriated. Consolidations in business and industry became popular to get rid of the cut-throat competition which had developed from the unlimited freedom. Consolidation and, in some cases, monopoly continued, and many small companies were forced out of business. Trusts with their monopolies, control of prices, and the elimination of the small companies soon caused a demand for government regulation, especially from those who were injured by the consolidations.

One of the early regulatory measures was the Interstate Commerce Act of 1887 which prevented railroads from pooling units to control prices and from making unjust charges and personal discriminations between localities. It ordered all fares and rates published. The Interstate Commerce Commission, which administered the law, was given the power to collect data, call witnesses, hear complaints, and render decisions. It was also required to submit annual reports to Congress. This act was not very successful, by reason of the opposition of the railroads, and, finally, in 1897, the Supreme Court held that the Commission did not have the power to prescribe rates and fix tariffs; thus the Commission's power and effectiveness were limited. Subsequent amendment modified the commission's powers and other conditions of the act. The Elkins Act of 1903 prohibited rebates and deviation from published rates; the Expediting Act of the same year gave preference in the circuit courts to cases under the Act; the Hepburn Act of 1906 and the Mann-Elkins Act of 1910 enlarged the scope of the Commission; and in 1916 the Adamson Eight-hour Act regulated the hours of labor in interstate traffic. The Adamson Act entered a new sphere in

governmental activity, that of regulating hours of work, and indicated a trend toward further extension of governmental regulation into industry.

With the economic and political thought of the 'eighties set against monopolies, public opinion was so aroused that federal legislation was demanded to prevent or to control trusts. After an investigation in 1888 by a committee of the House of Representatives, the Sherman Anti-trust Act was passed in 1890. The nucleus of the act was contained in the following sections:

Sec. 1.—Every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several states, or with foreign nations, is hereby declared to be illegal. . . .

Sec. 2.—Every person who shall monopolize or attempt to monopolize or combine or conspire with any other person or persons to monopolize any part of the trade or commerce among the several states or with foreign nations, shall be deemed guilty of a misdemeanor. . . .

Fines, imprisonment, and damages were provided for violators. Opposed by many as unnecessary interference with legitimate industry and as an attempt to break the inevitable doctrine of *laissez-faire*, the Act did not succeed at first because of the the poor business conditions which followed, the necessity for legal interpretation of the act, and the lack of enforcement by the government. Even later, the Act was considered as having but little effect upon the trend of industrial development,¹ except possibly with reference to labor unions.

Because monopolies had not been stopped, much "muckraking" of the trusts, and attempts to show their lawlessness and greed, occurred shortly after 1900. This caused the government to press prosecutions, which led to the dissolution of the Standard Oil Company and the American Tobacco Company in 1911. These dissolutions occurred in form, with little detrimental effect upon the companies. After waging their campaign in 1912 against the trusts, the Democrats, under the leadership of Wilson, caused the passage by Congress of the Clayton Anti-trust Act of 1912 in order to define precisely unlawful monopolistic practices. The Act forbade price discriminations, the interholding of stock except for investment, and interlocking directorates, and declared that labor unions and farm organizations were specifically not conspiracies in restraint of trade. About the same

¹ J. W. Jenks. *The Trust Problem*. 1905. P. 218.

time the Federal Trade Commission was set up to maintain competition.

Then came the World War, and the government took control of industry and commerce in the emergency under the Council of National Defense, and especially under its subsidiary, the War Industries Board. This board promoted and regulated the production, purchase, and distribution of war materials, credit, fuel, and labor. Government regulation and control of the railroads, having been an accepted policy since 1887, was extended in 1918 to the actual operation of the railroads. When the railroads were returned to private ownership in February, 1920, the cost of operation had exceeded the revenues nine million dollars for the twenty-six months of government operation. The administration considered the loss as a cost of the war; others alleged it was waste and poor management, and proved the impracticability of government ownership of industry. However, opposition did not prevent the passage of the Transportation Act of 1920, which provided a law under which the railroads were to be operated during the post-war period.

During the war, industry grew, production increased very rapidly, and foreign loans mounted until the United States changed from a debtor to a creditor nation. The industrial and business boom during the war subsided at the close. Because of the decreased outlet at home and abroad for the goods produced, and because of the accompanying economic conditions, the depression of 1921 occurred, which brought with it declining prices. Industry, with the increased efficiency and productive capacity developed during the war, could produce goods in such quantity as to meet the reduced prices. This, combined with the restriction of immigration, the application of science, the introduction and growth of new products, such as the automobile and radio, and better banking facilities, led to the great prosperity from 1922 to 1928. Agriculture did not keep pace during the years of prosperity, yet, on the other hand, industrial expansion and speculation overstepped themselves, which fact led largely to the depression which was started by the stock market crash in October, 1929. During the prosperous years after the war, the demand for government regulation of industry diminished somewhat. When the depression continued through 1932, the presidential campaign of that year was waged princi-

pally on a program of recovery. The victorious Democrats acted promptly, and the National Industrial Recovery Act¹ and other measures resulted.

Although the National Industrial Recovery Act was declared unconstitutional by the United States Supreme Court in 1935, it was a decidedly emphatic step toward governmental regulation of industry. The conditions of this act may show the trend of such regulation.

The purpose of the act was to "encourage national industrial recovery, to foster fair competition, and to provide for the construction of certain useful public works, and for other purposes."¹

The President of the United States was authorized to establish agencies to administer the Act and to delegate his functions and powers thereto. Upon application from trade and industrial associations or groups, the President was given the power to approve industrial codes of fair competition, which were administered by code authorities selected from the industry and appointed by the President. Employees were given the right to organize and bargain collectively through representatives of their own choosing without the interference, restraint, or coercion of employers. Maximum hours of labor and minimum rates of pay were recommended and approved by code authorities and sanctioned by the President. District courts were invested with jurisdiction to prevent and restrain violation. The codes did not permit monopolies or monopolistic practices, nor prevent any individual from pursuing the vocation of manual labor and selling, or trading the products therefrom.

Under this act over 500 industrial codes were approved and in effect when the act was declared unconstitutional on May 27, 1935. The organization of industry under the NRA is shown in Fig. 1. The principal reason for the unconstitutionality of the Act was given by the Chief Justice in his opinion as follows:

Section 3 of the Recovery Act is without precedent. It supplies no standards for any trade, industry, or activity. It does not undertake to prescribe rules of conduct to be applied to particular states of fact determined by appropriate administrative procedure.

Instead of prescribing rules of conduct, it authorizes the making of codes to prescribe them. For that legislative undertaking, Section 3 sets up no

¹ Public No. 67. 73rd Congress (H. R. 5755). See organization chart of NRA. Fig. 1.

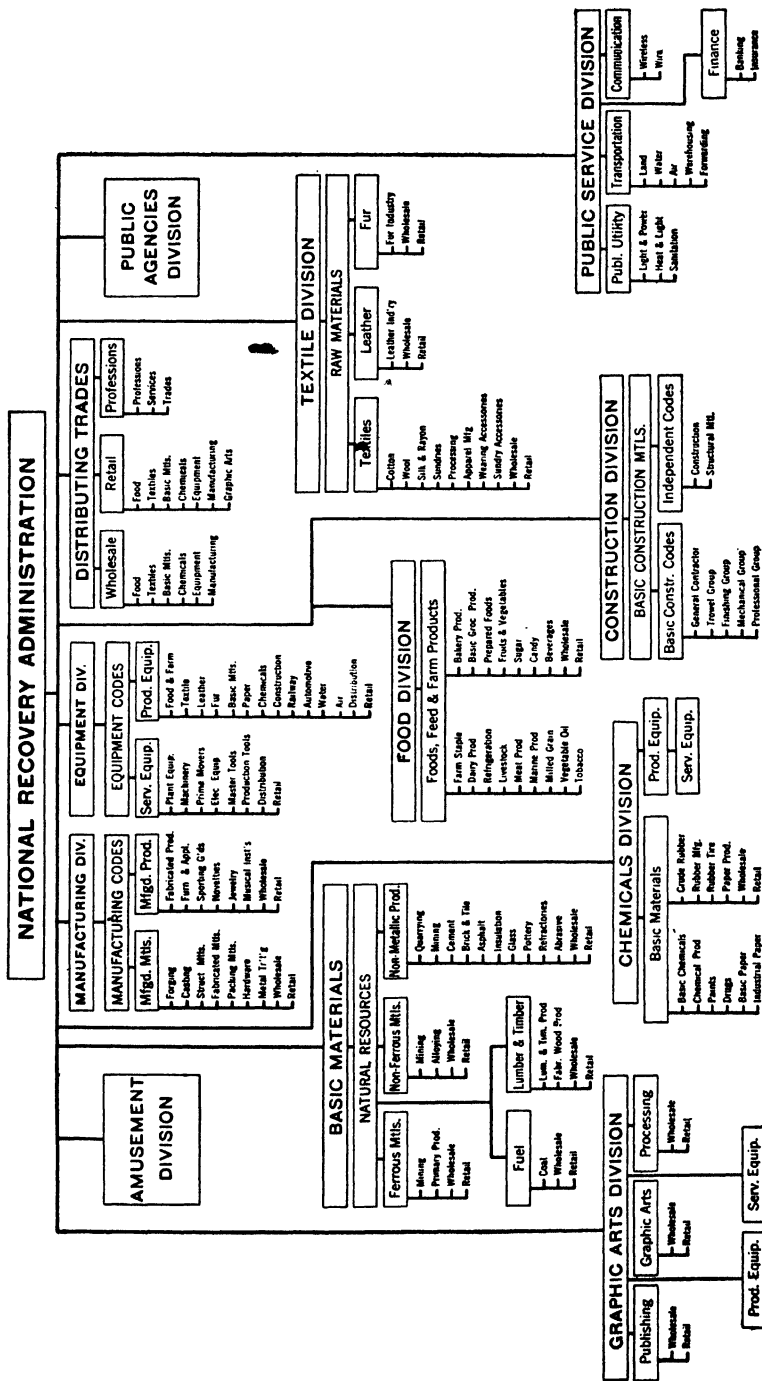


FIG. 1.—Chart showing typical organization of industrial codes under the National Recovery Administration. Devised from the *Blue Eagle*, N. R. A., Wash., D. C. Sept., etc., 1934-35.

standards, aside from the statement of the general aims of rehabilitation, correction, and expansion described in Section 1. In view of the scope of that broad declaration, and of the nature of the few restrictions that are imposed, the discretion of the President in approving or prescribing codes, and thus enacting laws for the government of trade and industry throughout the country is virtually unfettered. We think that the code-making authority thus conferred is an unconstitutional delegation of legislative power.¹

The NRA was accompanied and followed by a number of other regulatory measures, which made up the New Deal legislation. Some of them were: (1) the Agricultural Adjustment Act; (2) the Wagner National Labor Relations Act; (3) the Securities Act; (4) the Social Security Act; and (5) the Banking Bill.

In general, however, the history of American industry shows that its establishment was based upon a general historical development which had individual liberty and the desire for freedom from regulation as its background. As industry developed, if a man did not like his employer he could usually quit and move to new frontiers and start in for himself. This background of individual liberty and economic freedom may be the reason for the difficulties and objections to the recent regulation of industry and the individual as exemplified by the National Recovery Act and the Prohibition Amendment.

RECENT INDUSTRIAL BACKGROUND

Since about 1900, industry in this country has had an unusual development. The changes that occurred warrant study in order to understand industrial happenings today.

The population² of the United States increased from 62,947,714 in 1890 to 122,775,046 in 1930, a growth of 94 per cent.³ In 1890 the urban population consisted of 35.4 per cent and the rural was 64.6 per cent of the total, as compared to 56.2 per cent urban and 43.8 per cent rural in 1930.² The number of persons 10 years of age and over gainfully employed⁴ increased from 23,318,183 (or 49.2 per cent of the population) in 1890 to 48,829,920 (or 49.5 per cent) of the population in

¹ "Decision of Supreme Court on the National Industrial Recovery Act." *Monthly Labor Review*. Vol. 40. No. 6. United States Dept. of Labor, Bureau of Labor Statistics. Washington, D. C.: Government Printing Office. June, 1935.

² U. S. Bureau of Census. *Population*. Vol. I. 1931. Pp. 6-8.

³ Percentage calculations in this chapter were made on a slide rule.

⁴ U. S. Bureau of Census. *Abstract of the Fifteenth Census of the U. S.* Washington, D. C.: U. S. Government Printing Office. 1933. Pp. 305-6.

1930, an increase of 109 per cent in the number gainfully employed, but with the percentage gainfully employed remaining about the same.

The gainfully employed workers, 10 years of age and over, were divided according to occupations given in Table I.

TABLE I
GAINFULLY EMPLOYED WORKERS BY OCCUPATIONAL DIVISIONS: 1910-1930
(Source: U. S. Bureau of Census, *Abstract of the Fifteenth Census, 1935.*)

Occupation	1930		1910	
	Number in thousands	Per cent	Number in thousands	Per cent
1. Agriculture.....	10,471	21.4	12,388	32.5
2. Forestry and fishing.....	250	0.5	241	0.6
3. Extracting of minerals.....	984	2.0	965	2.5
4. Manufacturing and mechanical industries.....	14,110	28.9	10,656	27.9
Total in production.....	25,817	52.8	24,252	63.5
5. Transportation and communication.....	3,843	7.9	2,665	7.0
6. Trade.....	6,081	12.5	3,633	9.5
7. Public service.....	856	1.8	431	1.1
8. Professional service.....	3,253	6.7	1,711	4.5
9. Domestic and personal service.....	4,952	10.1	3,755	9.8
10. Clerical.....	4,025	8.2	1,718	4.5
Total in distribution.....	23,012	47.2	13,915	36.4
Grand total.....	48,829		38,167	

The number of persons employed in productive occupations increased from 24,000,000 in 1910 to 25,000,000 in 1930, a growth of 4 per cent, whereas the number employed in distributive and service occupations increased from 13,000,000 in 1910 to 23,000,000 in 1930, a growth of 76 per cent. This shows that the increase in population was mainly absorbed in the distributive occupations, and that our productive methods have improved to the extent that we need a relatively smaller percentage of persons to produce even more goods. We might also expect management methods to shift more to the distributive fields.

The relatively larger increase in the number of persons engaged in distribution than in production can also be shown by the fact that the productive occupations included 63.5 per cent of those gainfully employed in 1910, whereas in 1930 they included 52.8 per cent, a decrease of 10.7 per cent, with agriculture showing the largest decrease of the productive occupations, and trade and clerical occupations showing the largest increases in the distributive occupations.

TABLE II

INDEXES FOR POPULATION, WAGE EARNERS, PRODUCTION, AND POWER: 1899-1929

(Source: U. S. Dept. of Commerce, Bureau of Census. *Manufactures: 1929*. Vol. 1, General Report, 1933.)

Census Year	Indexes				
	Population	Wage earners	Production (quantity)	Production per wage earner	Horsepower*
1899.....	100	100	100	100	100
1904.....	110	114	122	107	133
1909.....	121	137	159	116	186
1914.....	131	146	169	116	224
1919.....	140	191	214	112	294
1921.....	145	147	170	116	†
1923.....	149	186	261	140	332
1925.....	154	178	269‡	151‡	359
1927.....	158	177	272	154	390
1929.....	162	188	295	157	431

* Covers rated capacity of prime movers and motors driven by purchased electricity.

† No data.

‡ Revised.

Manufacturing Industries. Manufacturing has grown in almost all its phases from 1899 to 1929. Table II gives a general summary of manufacturing industries by indexes from 1899 to 1929.

The number of wage earners in the manufacturing industries¹ increased 88 per cent from 1899 to 1929, whereas population increased 62 per cent, or a 26 per cent less increase than the number of wage earners. Based upon 1899 as 100 per cent, the index for the number of wage earners has been almost constantly about 25 per cent higher than that of the popula-

¹ U. S. Bureau of Census. *Manufactures: 1929*. Vol. I. General Report. 1933.

tion. From 1899, the number of wage earners rose more rapidly than did the population, until in 1921 the indexes for the two were almost the same (147 and 145). In 1922 the index for the number of wage earners rose much more rapidly again than did that of the population and remained relatively higher up to and including 1929, after which time the index of wage earners dropped rapidly to about 145 (of the 1899 base) in 1934. From 1923 to 1929 inclusive, the indexes for wage earners averaged 27.2 higher than those for population. This can be interpreted by some persons to show that the number of wage earners was higher than it should have been, and was doomed to fall sooner or later. It may also mean that if we maintained that number of employees for seven years we should be able to continue to do so. However, the fact that there was a large drop in 1929 may give some weight to the idea that there may have been "over-employment" or "over-production" in 1925 to 1929, and "under-employment" or "under-consumption" in 1934 and 1935.

General Statistics of Manufacturing Industries. A summary of the general statistics of the manufacturing industries from 1899 to 1929 is given in Table III. Manufacturing industries¹ may be viewed briefly, from the standpoint of the personnel employed, by the facts that from 1914 to 1929 the number of establishments increased from 117,110 to 210,959, about an 80 per cent increase; that the number of wage earners increased from 6,896,000 to 8,838,000, or 27 per cent; and that the number of wage earners per establishment decreased from 59 in 1914 to 42 in 1929. The number of proprietors and firm members decreased from 259,172 in 1914 to 133,210 in 1929, a decrease of 48 per cent. The number of salaried officers and employees increased from 962,533 to 1,358,775, an increase of 42 per cent or 15 per cent more than the increase in the number of wage earners. If the central administrative officers and salaried employees are included in the last item, the increase of salaried officers and employees would be 63 per cent, or 36 per cent more than that of the wage earners.

Manufacturing establishments may be becoming smaller; possibly the larger corporations are subdividing their companies into smaller and more highly specialized units, such as Henry

¹ U. S. Bureau of Census. *Abstract of the Fifteenth Census of the U. S.* Washington, D. C. 1933. P. 742.

TABLE III

SUMMARY OF MANUFACTURING INDUSTRIES: 1899-1929

(Abstract of the Fifteenth Census of the United States. Washington, D. C.: U. S. Government Printing Office 1933. Pp. 742, etc.)

Year	Number of establishments	Wage earners average for the year (thousands)	Wages (millions of dollars)	Cost of materials, containers, etc. (millions of dollars)	Value of products (millions of dollars)	Value added by manufacture (millions of dollars)
1929* . . .	210,959	8,838	11,620	38,549	70,434	31,885
1927* . . .	191,866	8,349	10,848	35,133	62,718	27,585
1925* . . .	187,390	8,384	10,729	35,935	62,713	26,778
1923* . . .	196,309	8,778	11,009	34,705	60,555	25,850
1921* . . .	196,267	6,946	8,202	25,321	43,665	18,332
1919* . . .	214,383	9,000	10,461*	37,232	62,041	24,809
1914* . . .	117,110	6,896	4,067*	14,278	23,987	9,709
1914† . . .	272,518	7,023	4,067	14,358	24,216	9,857
1909† . . .	268,491	6,615	3,427	12,142	20,672	8,529
1904† . . .	216,180	5,468	2,610	8,500	14,793	6,293
1899† . . .	207,514	4,712	2,008	6,575	11,406	4,831

* For all establishments having products valued at \$5,000 or more.

† For all establishments having products valued at \$500 or more.

Ford's gauge factory and other farm-factory plants. The trend seems to be toward decentralization of manufacturing into small plants making a highly specialized product by mass-production methods. Because the number engaged in the management of manufacturing is increasing faster than the number of employees, while the number of proprietors and firm members are decreasing, possibly management is replacing capital in the latter's dealing with the employees, or is acting as a "middleman" between capital and labor. Furthermore, if the number of decentralized establishments increases, there may be a greater need for an increase in management, whereas the improvement and increased use of machinery may not make it necessary for so great an increase in the number of employees. From the standpoint of salaries,¹ wages, and value added by manufacture, the increases were about double, or more than the increases in the numbers employed. During the period from 1914 to 1929, wages increased from \$4,067,000,000 to \$11,620,000,000, or 186 per cent; salaries, not including central administrative offices, increased from \$1,274,000,000 to \$3,595,000,000, or 182 per

¹ U. S. Bureau of Census. *Op. cit.* P. 743.

cent, which was at a rate a little less than the rate of increase of wages; if central administrative offices are included, salaries increased 230 per cent or 44 per cent more than wages; and the amount added by manufacture increased from \$9,709,000,000 to \$31,885,000,000, or 227 per cent. These facts indicate that wages and general salaries increased about the same, but that neither salaries nor wages increased so fast as the value added by manufacture.

The question then arises, "What are the percentages of the total added by manufacture, going to wages, salaries, and overhead and return to capital?" In 1914 wages comprised 41.3 per cent of the amount added by manufacture and in 1929 they were 37.2 per cent, a decrease of about 4 per cent. In 1914 salaries were 12.8 per cent of the value added and in 1929 they were 11.4, a decrease of 1.4 per cent or 2.6 per cent less decrease than that for wages; in 1914 the percentage going to capital and overhead was 45.9, and in 1929, 51.4, an increase of 5.5 per cent, and 9.5 per cent more than the percentage going to wages.¹ This may show that management and capital each received a slightly increasingly greater share of the value added than the wage earners did.

One alternative that may have entered in was that of an increasing overhead. In 1925 there were 84,646 salaried officers and employees in central administrative offices receiving \$225,512,798, and in 1929 there were 208,368 receiving \$600,437,331, an increase over 1925 of 147 per cent in salaried officers and employees, and 167 per cent in salaries in four years. This rapid growth in central administrative office force and salaries, however, may indicate a trend toward larger central managements. When this is combined with the fact that the number of employees per establishment is decreasing, the result may be a combined trend toward larger centralized administration of more decentralized highly specialized smaller plants.

The Gap of Personal Relationship between Capital and Labor, and Management and Wage Earners. If the number of wage earners per proprietor and firm member is increasing, the management relationships between capital and labor may be decreasing.

If we divide the number of wage earners by the number of

¹ *Recent Social Trends in the United States*. New York: McGraw-Hill Book Co. 1933. Vol. I. P. 231.

proprietors and firm members per year, we shall have roughly the number of wage earners per proprietor, from which we can determine the progress of these relationships. Table IV gives the number and indexes of wage earners per proprietor and firm member and the actual number and indexes of the number of wage earners per salaried officer and employee.

TABLE IV

NUMBER OF WAGE EARNERS PER PROPRIETOR AND FIRM MEMBER, AND PER SALARIED OFFICER AND EMPLOYEE, AND THE INDEXES, IN MANUFACTURING INDUSTRIES: 1899 TO 1929*

Year	Wage earners per proprietor and firm member		Wage earners per salaried officer and employee	
	Number	Index 1914 = 100	Number	Index 1914 = 100
1929.....	65.5	250	6.5	90
1927.....	63.0	238	6.4	89
1925.....	63.0	238	7.4	103
1923.....	59.0	223	7.6	106
1921.....	40.0	151	6.3	87
1919.....	36.0	136	6.1	85
1914.....	26.5	100	7.2	100
1909.....	23.7	90	7.8	109
1904.....	23.8	90	10.3	144
1899.....	....	....	13.0	181

* Calculated from the "General Statistics for Manufacturing: 1890 to 1929." *Abstract of the Fifteenth Census of the United States*. Washington, D. C.: U. S. Government Printing Office. 1933. Pp. 742-743.

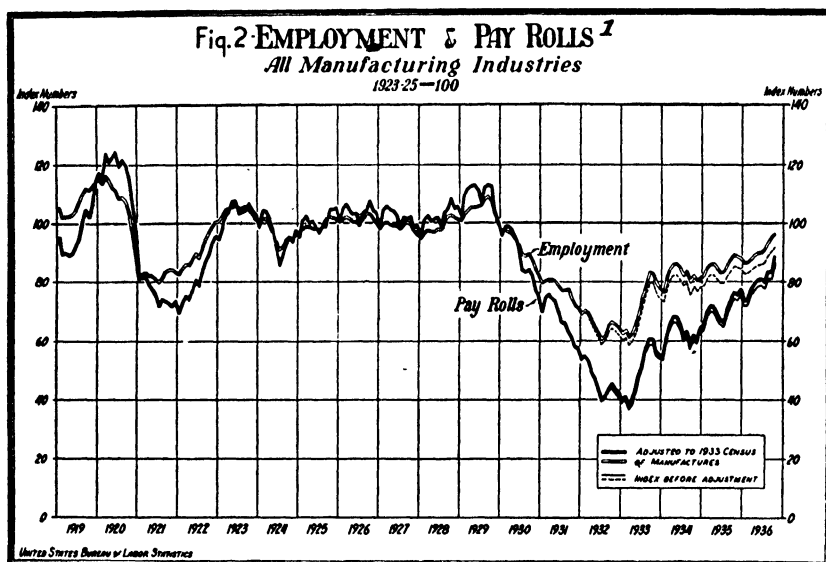
The number of employees per proprietor and firm member increased from 26.5 in 1914 to 65.5 in 1929, an increase of 150 per cent. From the point of view of management, relationships between capital and labor decreased. But another factor has entered into, if not replaced, these relationships.

In 1914 there were about 7.2 wage earners per salaried officer or employee. In 1929 there were 6.5 wage earners per salaried officer or employee, a decrease of 10 per cent. In 1899 there were 13 wage earners per salaried officer or employee, about twice as many as in 1929. In general, management is increasing more rapidly the number of employees, while the number of proprietor-capitalists is decreasing. The gap between capital and labor has increased faster and more than that be-

tween management and employees. Therefore, managers may be replacing capitalists in relationships with labor. Management has increased, along with the improvements in the science and art of management.

A further difference between salaried officers and wage earners can be seen from the difference in the amount of wages which each group received, and the changes which took place in these amounts.

In 1899 a wage earner made an average of \$425 per year in wages, and the salaried officer and employee made \$1,090



per year or 257 per cent as much.² In 1912, a wage earner made an average of \$590 per year, and in 1929 an average of \$1,315, an increase of 123 per cent. In 1914 a salaried officer or employee made an average of \$1,320 per year, and in 1929, \$2,650, an increase of 101 per cent, or roughly one-fourth less than the increase in the wage earner's average salary. If the salaried officers and employees of the central administrative officers are included, the average salary in 1929 would be \$2,680, or slightly more than twice the 1914 amount. The salary of the salaried officers and employees, throughout the period of 1899 to 1929,

¹ United States Bureau of Labor Statistics, *Employment and Pay Rolls*, October, 1936, Serial No. R.478.

² Calculated from U. S. Bureau of Census *Op. cit.* P. 743.

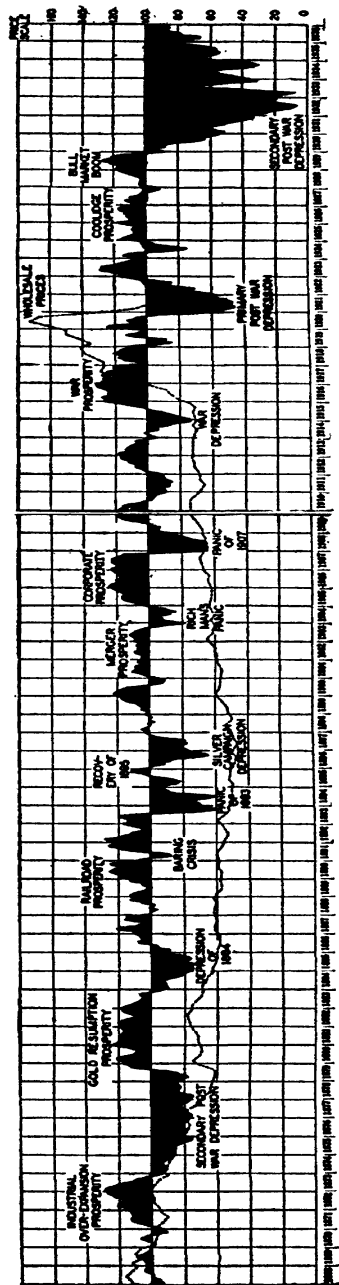
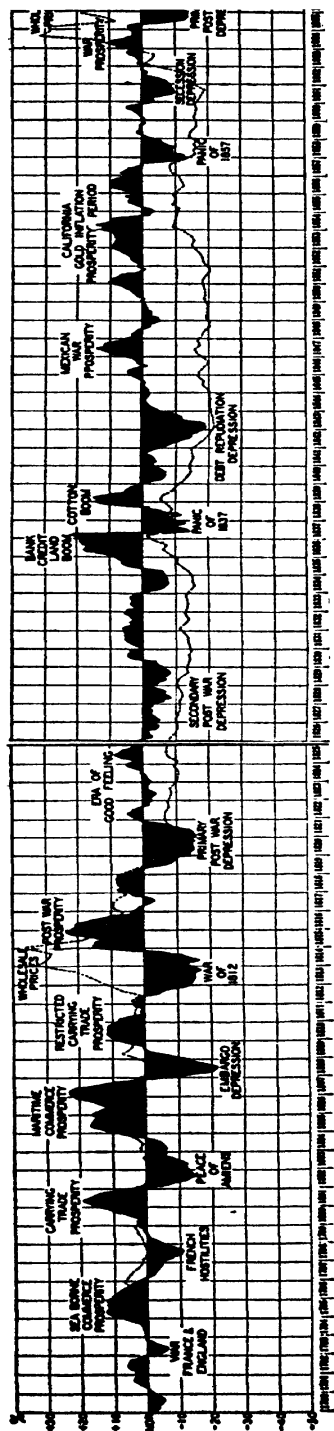
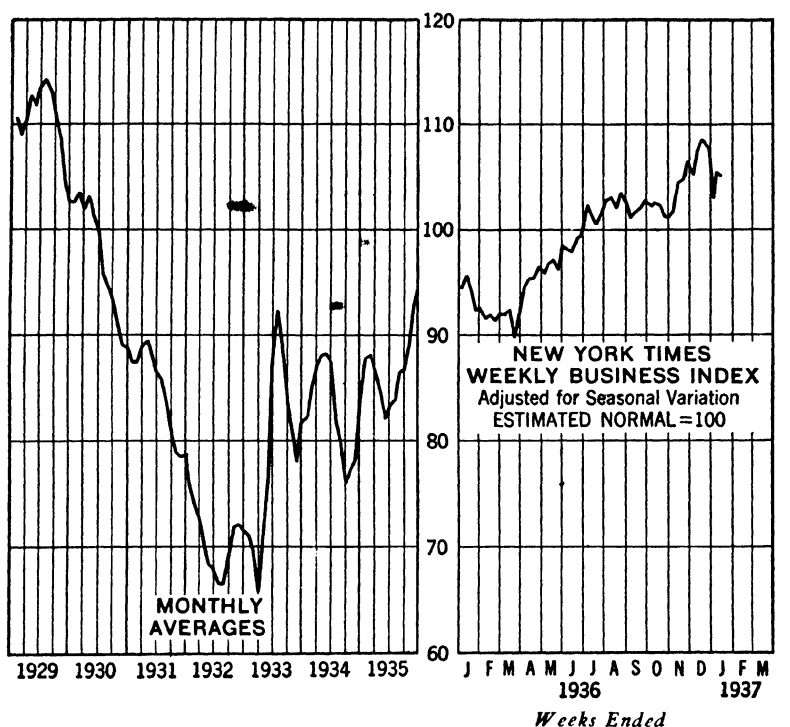


FIG. 3.—*American Business Activity Since 1790*, by Leonard P. Ayres, Cleveland Trust Company, Cleveland, Ohio, Jan., 1936. (With 1936 addition.)

remained from 172 to 257 per cent of the wages of wage earners, based upon 1899 as 100.



	Weeks Ended		
	Jan. 16, 1937.	Jan. 9, 1937.	Jan. 18, 1936.
Combined index	105.3	*105.6	94.1
Miscellaneous carloadings	95.2	96.8	93.9
All other carloadings	97.1	99.2	88.3
Steel ingot production	124.8	124.8	77.5
Electric power production	107.6	107.0	97.5
Automobile production	95.2	*100.6	110.8
Lumber production	69.9	68.2	83.2
Cotton-mill activity	143.8	*145.8	107.9

* Revised.

FIG. 4.—New York Times Business Index—1929 to 1937. (From *New York Times* Financial Section, January 24, 1937, Sec. 3-F, p. 1.)

In the previous paragraphs the discussion of industrial background has been principally that previous to 1929. What has happened since 1929 to the industrial and economic factors can be seen from the various bulletins and charts on employment,

pay rolls, etc., of the United States Bureau of Labor Statistics¹ and the various bulletins and charts of the National Industrial Conference Board.²

Figure 2 shows employment and pay rolls, as determined by the United States Bureau of Labor Statistics, from 1919 to 1936.

A general long-range viewpoint of American business and industrial activity since 1790 can be seen from Fig. 3, the chart *American Business Activity Since 1790*, published by the Cleveland Trust Company of Cleveland, Ohio, Leonard P. Ayres.

Business indexes from 1929 to 1936 are given graphically in Fig. 4, the *New York Times Weekly Business Index*. This is the combined index for miscellaneous loadings, other carloadings, steel mill activity, electric power production, automobile production, lumber production, and cotton mill production. It can be seen weekly in the Sunday *New York Times Financial Section*.

SPECIAL ASSIGNMENTS

1. Write out briefly your personal plan of equalizing and providing for adequate production and consumption in the United States.

2. Report in detail on some special phase of the English background, such as (a) the Trade Board Acts, (b) the Factory System, (c) Social Credit (Douglas), etc.

3. Report on some phase of the American background, such as (a) the National Recovery Administration, (b) the Wagner National Labor Relations Act, (c) the Social Security Bill, (d) the Industrial Revolution in America, etc.

4. Report on some phase of the industrial background, such as (a) the effect of the depression, beginning in 1929, upon production per worker, (b) decentralization of industry in the recent years (especially "Decentralization Trends in Factory Employment," *Monthly Labor Review*, November, 1935, p. 1212; and *Ford News*, February, 1933, pp. 26, etc.), and (c) other subjects.

5. Report on S. S. Wyer, *Living Together in a Machine Civilization*, Columbus, Ohio: Social-Engineering Fund, 1934, pp. 45.

6. Plot, on graph paper, curves of the indexes given in Table II, with the years as abscissas and the indexes as ordinates.

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AMERICAN BACKGROUND

- (2) E. S. COWDRICK. *Industrial History of the United States*. New York: Ronald Press Co. 1923.
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- (6) N. B. GASKILL. *The Regulation of Competition*. New York: Harper & Brothers. 1936.

INDUSTRIAL BACKGROUND

- (7) U. S. BUREAU OF CENSUS. *Abstract of the Fifteenth Census of the United States*. Washington, D. C.: U. S. Government Printing Office. 1933.
- See also the footnote references. ■

CHAPTER III

METHODS

POLICIES AND PRINCIPLES

Before a company can begin to act or produce, it must have a policy on which to base the action. A policy represents the central aim or guiding purpose of the organization. It is the idea by which the concern functions. It is the steering principle which focuses the company's activities upon a definite end.

In order to incorporate, a company must state its policy in its articles of incorporation. The reading of the object clause of a corporation's charter should disclose its fundamental policy. Examples of company policies are: "to supply gas heat for every heating purpose"—the People's Gas Light and Coke Company; and "to supply gas, electricity, and transportation to all of the State of New Jersey"—the Public Service Corporation of New Jersey.

Although these statements of policy may be definite, there appears to be a tendency in recent years to make the policies, or rather the object clauses of corporations, as broad as possible to allow for future changes.

Besides the underlying policy which guides the corporation activities, there are always general and specific policies, as well as external and internal policies, which are necessary for realizing the main objective. A company may be chartered to supply gas, electricity, or transportation to a certain locality, but there is a need for a general policy as to how it is to be supplied. Two companies may have the same purpose of producing the same product, yet one may have a policy of producing the best product with little regard for price, and the other, a policy of producing a good product at the lowest possible price. One company may be successful, while the other one may fail. A third company, chartered to manufacture the same product, may have a policy of manufacturing the best product at a fair price and accomplish more than the other two. From this, we can see that the company policy may be complex, yet very important.

We have often heard that if a policy cannot be written or stated, it is not definitely known or understood. One of the first qualifications of a good policy is that it be precisely and clearly stated and understood. The statement of a policy does not mean that it cannot be flexible and possible of amendment to meet economic changes, expansion, changes in material, changes in type and nature of production, changes in methods of distribution, business cycles, and other fortuitous circumstances. A constant or periodic reconsideration of policies is essential.

Besides the general and ultimate policies, there are administrative and divisional policies, such as those with reference to sales, purchasing, production, finance, and personnel, or with reference to the product, customers, prices, etc. Further than these, the company's policies must cover the phases of management, those that relate to methods, money, men, materials, machines, manufacturing, marketing, and measurement.

The American Rolling Mill Company considers the following policies¹ necessary to a comprehensive management program:

First: To do business guided and governed by the highest standards of conduct and ethics, striving always for that sort of ending in all things affecting the conduct of the business as would make "reputation" an invaluable and permanent asset.

Second: To adopt "Quality and Service" as a slogan. Quality, the highest attainable, to be represented in Product, in Organization, Plant, Property, and Equipment. Service, the best possible, to be rendered to Customers, to Stockholders, to City, State, and Nation.

Third: To make every possible effort to develop and maintain an efficient, loyal, aggressive organization, who believe in their Company, to whom work is a pleasure, and extraordinary accomplishment a personal ambition.

Fourth: To provide the best equipment and facilities obtainable, suitable to the particular needs of the business, both from the standpoint of economy in maintenance and operation and that of giving the Company's organization the best possible tools with which to work.

Fifth: Never to be satisfied with anything less than the best results possible of attainment in each and every problem to be solved.

Sixth: To be *consistent* and *persistent* in the application of Armco Policies to each and every situation.

In dealing with an individual or a group, always to give the situation or problem in hand every possible consideration after securing all attainable facts.

Seventh: In all decisions affecting the conduct of the business, to consider

¹ C. H. Murray. "What Personnel Policies Are Included in A Comprehensive Industrial Relations Program?" *Personnel*. New York: American Management Association. Vol. 12. No. 2. November, 1935. Pp. 173-174.

always what is right and best for the business as a whole, rather than what may be expedient in dealing with a single situation.

The following are the main planks in the platform on which *Armco* organization has been developed:

1. *A Square Deal*: To insist on a square deal always to every one. There are two kinds of square deal. The *Armco* kind is born of the belief that we should do right for right's sake and not simply to secure a desired result. The other kind is born of a selfish purpose, and that "Square Deal" is simply used like cold steel—as an instrument of accomplishment. It is the body without the spirit; the hand without the heart; and it cannot be permanently effective.

2. *Compensation*: To provide not only fair remuneration, but the best Compensation for service rendered that is possible to pay under the changing economic, commercial, and other competitive conditions that exist from time to time. It is *Armco's* ambition to develop an organization of such spirit, loyalty, and efficiency, that it can and will secure results which will make it possible for individual members to earn and receive better compensation than would be possible if performing a similar service in other fields of effort.

3. *Incentive*: To provide every possible and practical sound Incentive to best effort, as it is the great mainspring of all human accomplishments.

Life, as organized, has many incentives that urge us on to do our best in our chosen field of effort. Loved ones dependent on us for care, protection, and education, provide one of the greatest incentives which come to a normal man. Organized industry can, however, add other real incentives which should make for increased efficiency and more certain progress.

4. *Opportunity*: To provide every possible Opportunity for advancement, as it is the ladder on which the individual hopes to reach his ultimate goal—his heart's ambition. Without such a ladder, there can be no such hope, and without hope, life may be a failure. It is a fixed *Armco* policy to provide such training Opportunities as will give the individual substantial aid to his advancement.

5. *Working Conditions*: To create and maintain both good and safe working conditions. *Armco* believes that good and safe working conditions in the fullest sense of the expression, are absolutely essential to industrial efficiency and progress. For that reason, concerted effort is continually to be made to provide equipment such as will make for cleanliness and orderliness and safety, and such training as will reduce to a minimum the possibility of accidents through the organization.

6. *Living Conditions*: In every possible way to encourage good living conditions. *Armco* believes that good living conditions, in both home and community, are essential to the highest individual efficiency; that happiness, which every human being craves, cannot be attained without them.

7. *Mutual Interest*: Such organization activities as will clarify and enlarge the Mutual Interest is the "cement" that binds a group of men and women together in every sort of productive effort. Without a true "Mutual Interest" there can be no serious application, no real loyalty, no cordial cooperation, and little chance for concerted and effective effort.

8. *Cooperation*: Through the operation of an Employee Representation Plan a measure of understanding has been and always will be developed that

will result in real Cooperation between management and the organization at large.

Cooperation is the medium through which all great accomplishments are attained. Success, ultimate and complete success, depends more on a spirit of helpful cooperation than on any other one factor.

With policies established and clearly stated, one of the first steps in modern management is that of organization into logical divisions, jobs, and elements of jobs to carry out the ultimate policy decided upon. This is accomplished by means of general organization, job analysis, descriptions, evaluation, specifications, and time and motion study.

ORGANIZATION

Organization is the division of work into its proper functions, jobs, and elements; their arrangement into correct relationships; and the assignment of them to individuals with clear definitions of responsibility, authority, and duties which will accomplish the policies of the establishment.

In the early days, industry was made up of individual enterprises and small shops. The owner worked side by side with his workers. He could keep track of his work almost by memory. He rarely kept records, because of his proximity to the business. As the shop grew into the small factory, and the factory into the corporation, it was no longer possible for the owner or the manager to know all the members of his organization. This brought the need of organizing the men into groups for unified, concerted effort. In these early days, the administration of industrial establishments depended principally upon the personality of the owner or manager, and empirical methods were used. What the manager thought or believed was the working principle of the organization and its activities. As industry and enterprises grew, it became necessary to substitute scientific methods for those based mainly upon executive opinion. The substitution of facts for the manager's "I believe" or "I think" was expedient.

The first trace of a definite and clearly defined organization was in military departments, where many men were assembled into groups and disciplined to function into a sharply defined, smooth-running organization, which could be maneuvered as one mass. As the military units were the first to organize men for mass administration, this was naturally the first example for the organization of industry. Therefore, most of the early types of

industrial organization were those modeled after the military organization—hence the *military* or *line* type of organization, as shown in Fig. 5.

In this type of organization, discipline is the essential feature, and authority goes in a direct line from superior to inferior, from the highest to the lowest, until every man in the organization is included. Direction and instruction are vertical, as, for example, from the president to the general manager, to the foreman, and to the workmen. The foreman in one department has little or nothing to do with the foreman in another. He is responsible directly to his superior. The chief advantages of the line organization are that discipline can be quickly effected and

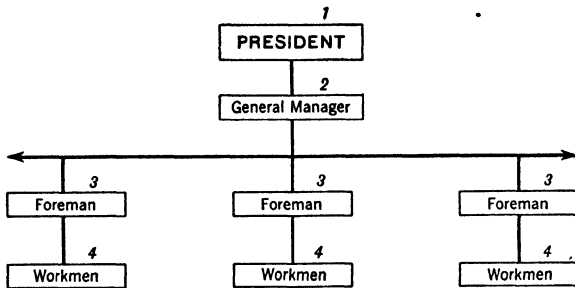


FIG. 5.—The Line Organization. (Note: The numbers refer to salary levels of jobs.)

changes speedily made, that responsibility and authority are absolute and definitely placed with minimum friction, red tape, and time, and that responsibilities can be readily understood.

As industry expanded, jobs in the factory not only increased in number, but also became more specialized, necessitating that each man become highly efficient at a smaller number of duties. As each job became more specialized and intricate, the range of knowledge and experience required in a manager increased until industry attained such colossal proportions that the personality of the individual manager or "boss" could no longer encompass all the essentials of his company or department. He was obliged to solicit the aid of specialists and advisers in certain fields. For example, while the shop was small, the owner or manager could sell the products which were made, because marketing required little knowledge, as almost everything produced could be sold with little difficulty. As production improved, the marketing processes became more complex, and it became nec-

essary to assign special persons to study and know the selling field. Therefore the manager annexed to his organization a specialist in selling or marketing who could find out the selling facts and advise him upon the best marketing methods to use. Similar situations existed with reference to engineering, purchasing, and various other manufacturing functions. This development led to the *line-and-staff type* of organization. This is the old line organization, supplemented by a staff of specialists who advise the executive or executives of the company concerning specialized fields, and cooperate with all persons in the concern who perform those or related functions, so that the best manner of accomplishment in the field or fields can be attained.

In the *line-and-staff type* of organization, the responsibility for expert knowledge and advice in the field of specialization is given to the staff of specialists who concentrate their efforts on those specific functions and give to the line organization the best knowledge in those particular fields.

The advantage of the *line-and-staff* organization is its conduciveness to higher specialization through investigation, the accumulation of facts, the establishment of standards, and the maintenance of checks of performance. The staff specialist can know the facts about his work more thoroughly and systematically than the line officer with his multifarious duties to perform. The line-and-staff organization permits specialization and, at the same time, maintains the straight-line principle of undivided responsibility and authority. However, the staff organization may be ineffective for enforcing that authority which is necessary to maintain a certain standard of performance, as it may develop friction between the staff and line executives. Where the proper spirit of cooperation prevails, the line-and-staff type of organization can work effectively for good discipline and high specialization.

In regard to the relationship between the line and staff, Mr. E. W. Smith¹ of the General Motors Corporation gives the following principles:

1. Line and staff are jointly responsible for performance.
2. A line officer discharges his responsibility by taking direct action; a staff officer discharges his responsibility by furnishing information and advice which

¹ E. W. Smith. *Organization and Operating Principles*. New York: American Management Association. General Management Series. No. 112. 1930. P. 17.

he makes available to the line officer unselfishly and without thought of personal credit for the results accomplished.

3. Although staff executives are charged with responsibilities that have to do with internal administrative phases of the work in their own departments, this does not give them direct authority over the line forces in subordinate organization strata, nor does it relieve their line superiors of the basic responsibility for the results of their work.

4. The line recognizes the purpose and value of the staff and makes full use of its advice and assistance. In order that the line may properly do so, the staff must create for itself an "authority of ideas," and must, by competence and tact, obtain and justify the line's confidence.

A chart of a *line-and-staff* organization is shown in Fig. 6. In the latter part of the last century, Frederick W. Taylor

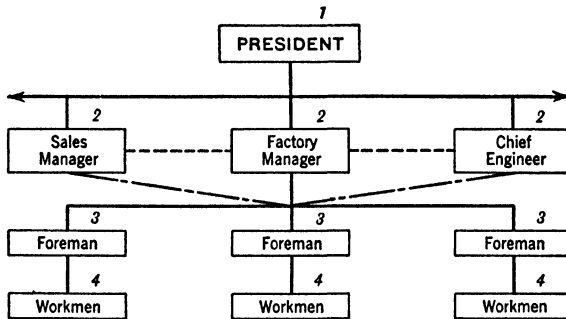


FIG. 6.—The Line-and-Staff Organization.

developed a *functional type of organization* whereby specialists in their particular fields had actual control of functions, instead of advisory service, as was found in the *line-and-staff organization*. Under the superintendent in the steel mill he had an order of work clerk, a gang boss, an instruction card clerk, a speed boss, a time and cost clerk, an inspector, a disciplinarian, and a repair boss, who had full control over their respective functions. For example, the speed boss had complete control over the speeds at which the machinery would be run and at which the metal would be cut in the machines. The order of work clerk had full control over the order in which operations would be performed; the disciplinarian handled all discipline; the repair boss specialized in repair work, and so on, until all the functions were performed and controlled by these functional foremen. This development led to a *functional organization* where *functionalized* specialists had the same authoritative control over their functions as line executives had over the various line activi-

ties. In the purely functional organization, each worker would receive instructions from as many persons as there were functionalists, and each specialist would furnish expert knowledge and require skilled performance of his function. The *functional type of organization* is shown in Fig. 7. In this chart the chief engineer has control over all engineering functions of the foreman and workmen. Likewise, the sales manager has functional control over all matters relating to sales.

The principal advantage of the functional type of organization is that it permits the highest degree of specialization in the many and various functions which cannot be performed by one person in the line organization. The disadvantages of this type are that it may weaken discipline, responsibility, and authority,

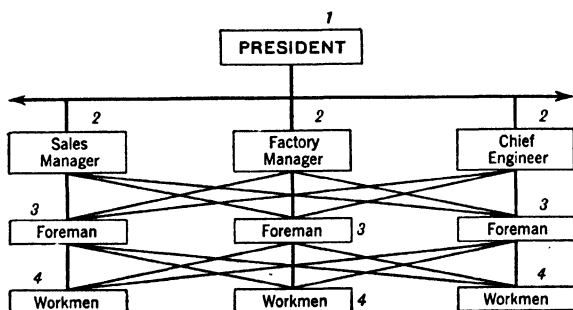


FIG. 7.—The Functional Organization.

and requires a high degree of coordination of the work of specialists who know fully the facts about their fields.

There is some belief that a highly functionalized organization cannot work smoothly, because of the great loss of discipline under several bosses. However, it has been emphasized considerably since Taylor's work that one man may tell a person where to go, another how to go, another how fast to go, etc., without an overlapping of instructions. However, one rarely, if ever, finds an organization which is entirely of one type, such as a line organization, a staff organization, or a functional organization, but usually a combination of these, as a *line and staff*, a *line and functional*, or a *line, staff, and functional organization*.

Often the various types of organizations are intermingled by the use of committees, each of which performs either functional, staff, or line duties. These committees may actually control, they

may investigate, they may discuss, instruct, or advise. They usually serve to coordinate various types of activities.

Each of these types of organization or their combinations must be adapted to a particular company, or a completely new type of organization built in order to achieve the specific policy of the company. The types of organization are greatly influenced by the personalities of the executives, the type of product, number and individuality of the employees, the *esprit de corps* and general morale, and the policy of the company. Each company must be analyzed with reference to all these factors and the type of organization best adapted to them devised.

A company is made up of individuals each different from every other. This would require that employees should be organized and managed individually, yet there are sufficient similarities in a group of people to facilitate a general plan of organization. Therefore it is essential that the type and method of organization apply to as many of these similarities as possible, yet provide ample opportunity for handling individual differences. With reference to this Henry Dennison¹ has said:

The ultimate in organization would require that the incentives, regulations, and personal contacts of each member should be such as to allow him to develop and put to most valuable use all of his powers. Since no two members are exactly alike there would be, theoretically, separate provisions for each. But all members, though different, are compounded of quite similar elements; their differences are in large part differences in the proportions in which these elements are represented. Hence, some reasonably uniform general measures can usually be devised to appeal to, to satisfy, and to control the more widely prevalent elements of human nature. An important practical task of the organization engineer lies in so grouping the personnel and devising the general rules that the largest possible number are effectively provided for; at the same time, he must be ready to deal with individual cases wherever the unsuitability of general rules causes losses which outweigh their gains in convenience and cost of administration.

The structural form of an organization affects and alters the spirit which works through it. The spirit alters and re-creates the structure. The running of an organization and the building of it depend upon each other—affect and are affected by each other.

The importance of right structure of organization is sometimes undervalued, because with the right men almost any kind of organization can run well. This is true, but is by no means the whole truth. With the finest of personnel, an illogical organization structure makes waste through internal friction and lost motion; it fails to retain and develop good men and to invite

¹ Henry Dennison. *Organization Engineering*. New York: McGraw-Hill Book Company. 1931. Pp. 4-6.

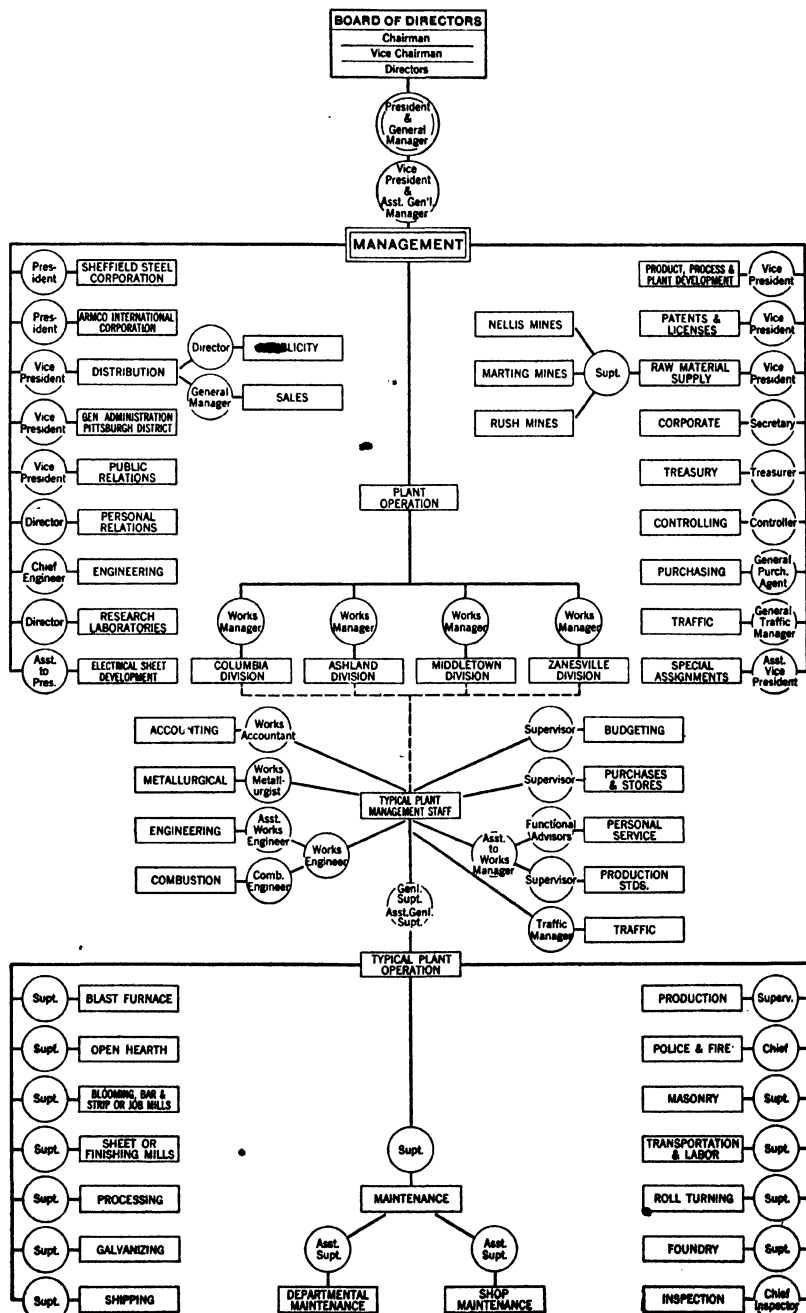


FIG. 8.—Organization chart of the American Rolling Mills Company, Middletown, Ohio. (Prepared for the author by C. H. Murray, Assistant to the President.)

into its membership new men of high quality. Ability, tact, and good purpose cannot be established by law—they can, however, by law be made possible or virtually impossible. With an able man in charge, cities have been run well under the crudest form of political structure; but crude forms of political structure rarely make it possible to get a really capable man to run and be elected to office. The same is true in a corporation. A logical, well-constructed organization invites, retains, and develops good men.

In general, the organization may be subdivided by (1) functions, such as sales, purchasing, and engineering; (2) product, embracing the principal kinds of products of the company; (3) geographical divisions, such as the eastern or western division; (4) process, such as veneering or finishing in a wood manufacturing plant; and (5) equipment, such as lathes, planes, milling machines, and grinders.

The trend in manufacturing seems to be to make the divisions of the companies more according to functions, such as sales, production, engineering, personnel, finance, and purchasing. Each function may be centralized, where one person or department performs that function for the entire company, or decentralized, with someone performing that function in each principal department. Centralization, of course, is naturally dependent upon the size of the company, because the small company cannot have a number of such functionalists for each small department. Centralization, in general, makes for uniformity of standards, methods, performance, and increased volume of work, but usually raises overhead and lacks flexibility and speed of action.

In order to show particular applications of these methods of organization, the organization charts of the American Rolling Mill Company, the United States Gypsum Company, and L. S. Ayres & Company are shown in Figs. 8, 9, and 10. These charts of the companies show the various interrelations of organizational divisions by functions, products, and geographical sections.

The Organization of the Typical Manufacturing Company. From the study of a number of organization charts of manufacturing concerns a typical plan of organization was devised, and is given as Fig. 11. The typical manufacturing organization starts at the top with the stockholders of the company, who elect a board of directors. The directors define the policies of the company. In the larger companies the directors usually appoint an executive committee to pass upon executive matters in the ab-

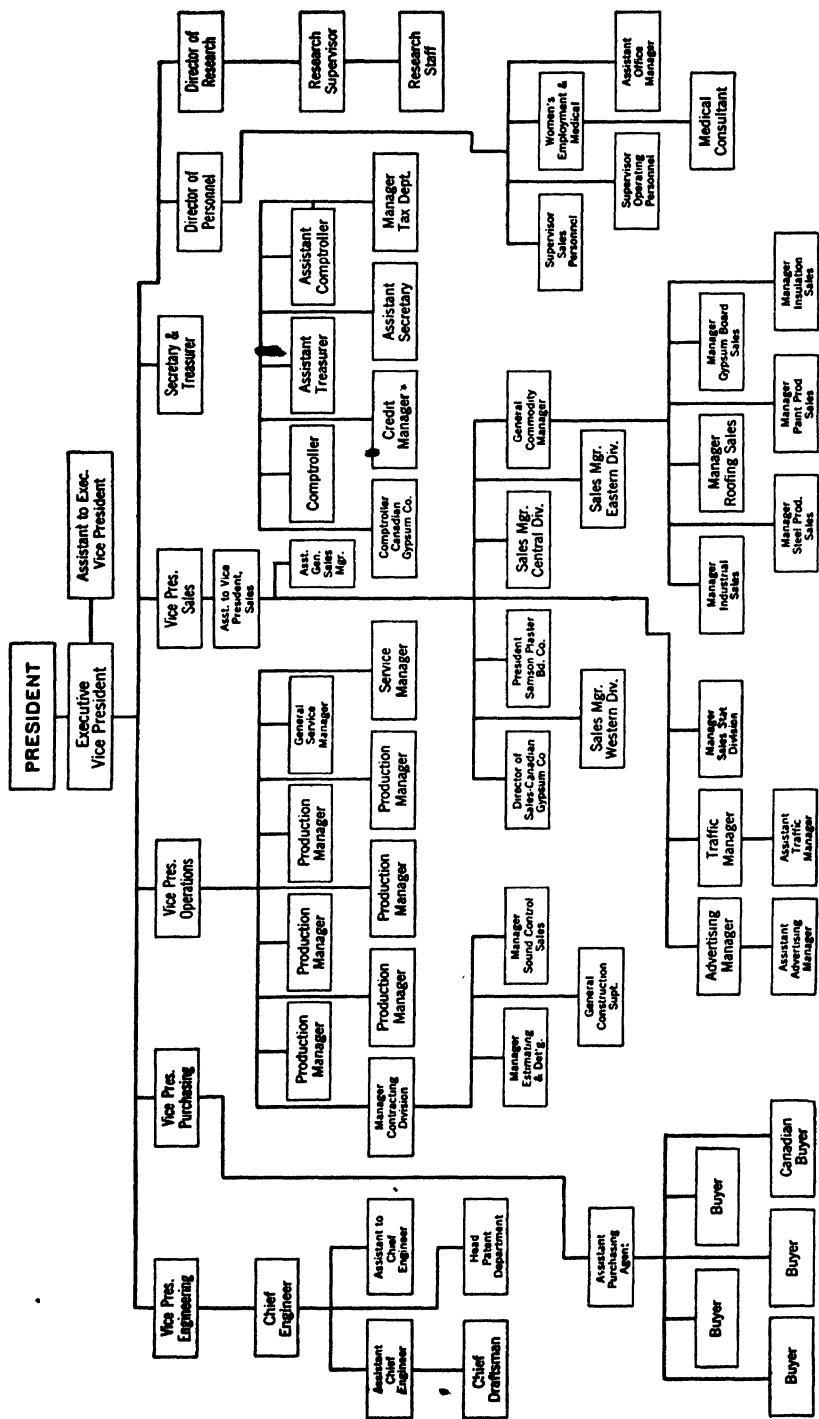


FIG. 9.—Organization chart of the United States Gypsum Co. (Prepared by R. H. Macalister, Employment Supervisor, 1936.)

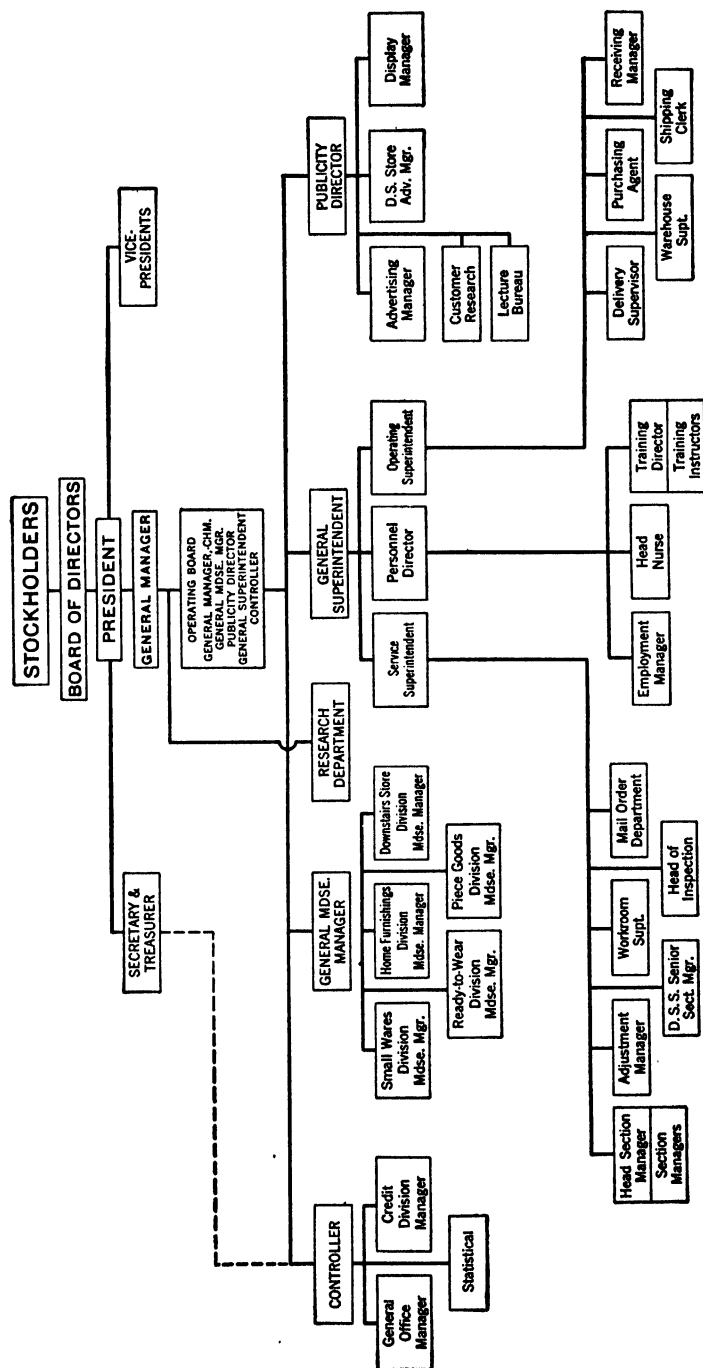


FIG. 10.—Organization plan of L. S. Ayres and Company, Indianapolis, Indiana.

sence of the board of directors, and a finance committee which handles financial matters.

The directors elect a president, who is responsible to those directors for the management of the company. Assisting the president in the management are the vice-presidents and officers who have charge of the special management functions. These functions are usually as follows:

1. *Marketing*, with a vice-president who has charge of (a) market analysis and planning, (b) publicity and advertising, and (c) sales and sales promotion.

2. *Manufacturing*, with a vice-president who has charge of (a) production, (b) research, (c) engineering, (d) inspection, and (e) planning. Under the direction of the vice-president in charge of manufacturing, the production manager manages the production departments. The superintendents and foremen have direct supervision of the workers in these various production departments. Receiving, shipping, traffic, and stock and stores are under the supervision of the materials manager, who reports to the production manager. The chief engineer is in charge of the engineering work of the company. He reports to the vice-president in charge of manufacturing. Under the chief engineer is a works engineer, who has charge of heat and power, maintenance, equipment, and the tool room, and an assistant engineer, who has charge of the design, and development. The superintendent of planning, who also reports to the vice-president in charge of manufacturing, has charge of standards and methods, processing, routing, scheduling, and production records.

3. *Personnel*, with the vice-president, who has charge of (a) employment, (b) personnel maintenance, (c) training, (d) health, (e) safety, and (f) service work. The vice-president in charge of personnel is often called the director of personnel or manager of industrial relations.

4. *Finance*, with a vice-president who has charge of the (a) corporate financing and funds, (b) budgets, (c) purchasing, (d) credit, and (e) accounting. Under the vice-president in charge of finance is usually a purchasing agent, who has charge of the purchasing, and a comptroller, who manages the credit, cost accounting, and general accounting

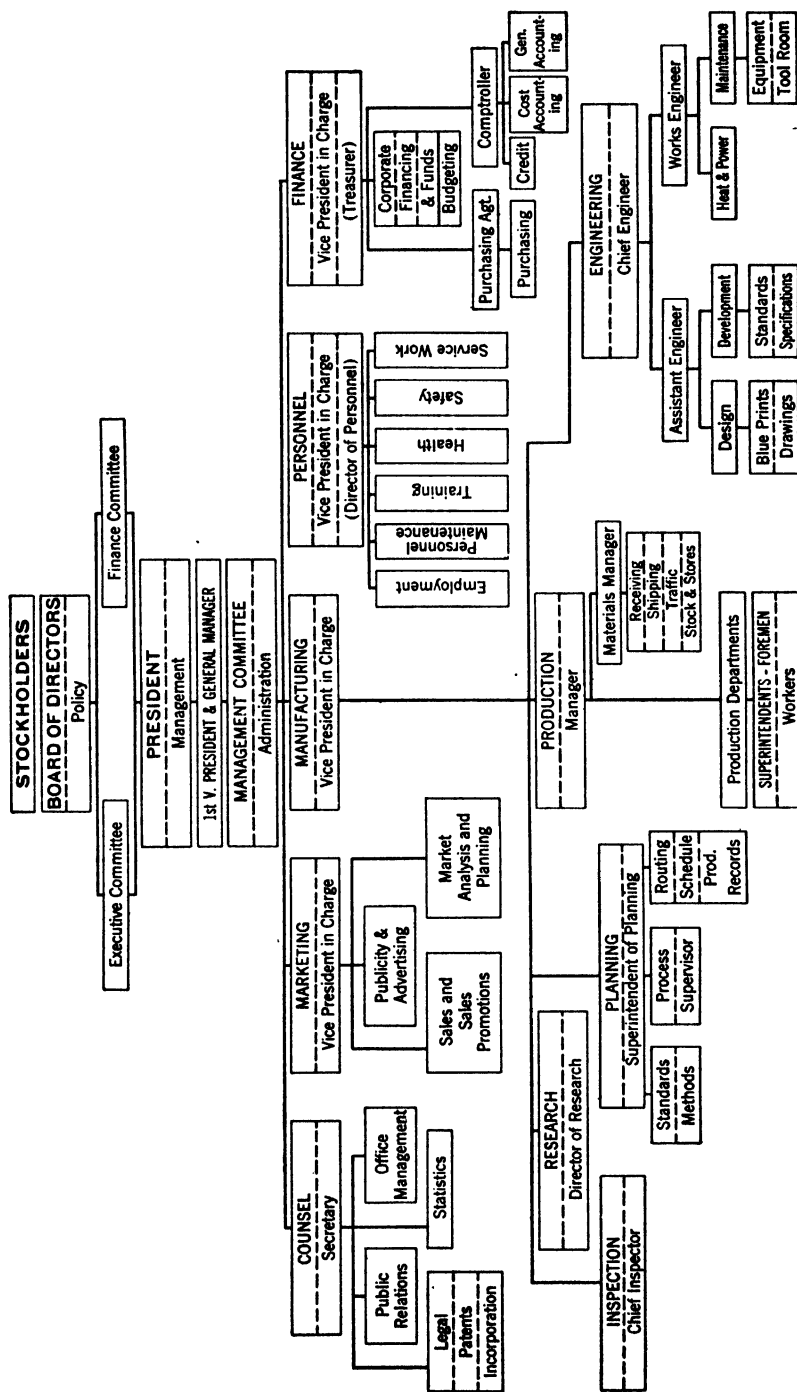


FIG. 11.—Organization chart of a typical manufacturing establishment.

activities of the company. In many companies the treasurer has the status of vice-president in charge of finance.

5. *Legal counseling and secretarial duties*, with a secretary, who has charge of (a) public relations, (b) office management, (c) statistics, (d) legal activities, patents, and incorporation activities.

Although this organization is described as typical, no one company will probably follow it exactly. The organization chart of each company will be adapted to the various M's in management as they are found in that company. As one company differs from another in the M's of management, so will it differ in organization. However, this typical organization chart, devised from a number of specific organization charts, is given as a generalized sample of organization. For example, as a majority of the organization charts considered had the engineering department organized under the vice-president in charge of manufacturing, the engineering function has been placed under the manufacturing department in the typical chart, and so on as shown in Fig. 11.

The description of the development of different types and kinds of organizations and their examples leads to the principles of organization, which may be stated as follows:

1. A logical division of the work into departments which will accomplish the policy of the company, their arrangement in proper relationships, and the making of a chart showing these departments and relationships.

2. An adequate division of labor into positions and a comprehensive statement of the duties of each job; the assignment of the right person to each job, and his acceptance of the responsibilities for carrying out his duties.

3. A definite study, understanding, and written description of the various elements of each job.

4. Constant adjustment and adaptation of all phases of organization to changing conditions.

5. Simplification, standardization, and systematizing through coordination of the various units of organization to achieve the aim or policies of the company, as well as the proper morale or spirit.

JOB DESCRIPTION, EVALUATION, AND CLASSIFICATION

The second principle of organization is the adequate division of labor into jobs or positions, and a comprehensive statement and evaluation of each job and the assignment of the right person to it. In some companies the work of describing and evaluating jobs is called "job analysis and job specifications"; in others, "job descriptions," "position evaluation," etc.

In 1934 a survey of the personnel activities in 233 companies showed that a larger number of those industrial concerns was considering adopting job analysis and specifications than any other type of personnel procedure. The situation indicated then seems to be arriving from the recent results accomplished in job descriptions and evaluation in the United States Gypsum Company, the Westinghouse Electric and Manufacturing Company, the B. F. Goodrich Company, the Socony-Vacuum Corporation, and others.

Industry wants to know exactly what each job consists of and what it is worth. The Social Security Bill and the unemployment insurance laws are causing employers to consider carefully whether an employee is absolutely needed before he is hired. When they do employ a person, they want to know exactly for what they are employing him, what the job is worth to the company, and what the employee actually does. The job description and evaluation procedure should do that and more too. It attempts to improve present jobs through clarification of duties, elimination of overlapping of duties, and prevention of misunderstandings as to work to be performed, and to fix responsibility more definitely. It will provide the personnel and employment manager with a definite basis for employment and training, and thereby improve hiring and training. It should help to prevent grievances by giving the management the actual distribution of wages and salaries. Increases or decreases in salary due to personal likes and dislikes should be prevented and wages more commensurate with the work performed should be provided. It may even bring to light unnecessary jobs and elements of jobs and eliminate them, and in the end help the management determine the relative value of various positions in a department or different departments, and establish the maximum and minimum salaries for each position.

If the methods which the companies mentioned in the second

preceding paragraph use in making job descriptions, evaluations, and classifications were studied and coordinated into a general method for doing this, something like the following directions for obtaining job descriptions and making evaluations would result. The procedure would include (a) job descriptions, (b) job evaluation, and (c) job classification as follows:

(a) **Job Descriptions.** 1. Choose one department in which to try out the procedure so that difficulties with this procedure can be ironed out before they occur generally.

2. Have the personnel manager or the official responsible prepare detailed instructions for making a job description, a blank form to be used in making it, and a good sample description, all of which are distinctly applicable to the company concerned.

3. Give a sufficient number of analysis blanks to each foreman or department head to be passed out to all the employees, with the request that those employees fill out the forms carefully in accordance with the written instructions and samples. Of course this applies to those employees who can read and write or write fairly well. In other cases the foreman or person making the descriptions may have to do it by talking to the employees. The announcement of the whole plan should come from the president of the company and over his signature.

4. After the forms have been filled out by the employees, the foreman reviews, edits, and makes additions to the employees' descriptions. This is very important, as the foreman should endeavor to make the job description unmistakably clear so that it can be given to a new worker coming on the job. Foreman training in the making of job analyses and descriptions may be needed.

5. After the foreman has reviewed and edited the descriptions for all the jobs in his department he returns them to the personnel officer or person in charge of making these descriptions, who then reviews, condenses, adds to each description, and returns all of them to the foreman for editing before the final drafts are made. The final draft can serve as a basis of employment, training, wages disputes, and organization work.

(b) **Job Evaluation.** After the job descriptions have been made in the proceeding manner, the person in charge of this work, the industrial engineer of the plant, or some one else designated by the management, should then evaluate each job, first *without regard to the wages actually being paid*. This eval-

uation should take into consideration the responsibility involved, the difficulty and volume of work, the supervision required, the supervision of others, the mental effort, the knowledge, training, and experience required, the conditions under which the work is done, etc.

(c) **Job Classification.** After each job has been described and evaluated, the superintendent, the department head, the personnel manager, and the foreman should cooperatively consider

FIG. 12.—SUGGESTED POSITION DESCRIPTION BLANK

Date_____ Name_____

Position_____ Location_____

Department_____ Division_____ Section_____

Dept. Head_____ Div. Head_____ Immediate Supervisor_____

1. Duties: Describe accurately. See instruction sheet. Use reverse side of this sheet, if necessary.

A. Daily (those which occur regularly every day):

B. Periodic (those which occur regularly at longer intervals—every week or month):

C. Occasional (those which are done in spare time or at irregular intervals):

2. Equipment and Machinery:

3. Supervision of Others (state number and their positions)_____

4. Contacts (insert whether personally, by telephone, or by correspondence)_____

With Public_____ With Other Depts._____

5. Remarks (add here any statements which might describe more fully the scope of your job):

Approved: _____

(If a Personnel Record is not available for every employee, a personnel blank can be added on the reverse side of this and filled in at the same time.)

and classify the positions from their evaluation. The positions should be arranged from the lowest to highest and classified into groups of the same kinds and responsibilities. Then the wages and salaries can be added to the consideration and a distribution of them can be made from the highest to the lowest. The wages and salaries which are too high or too low can then be considered and reasons given or adjustments made.

This procedure should result in a more uniform wage plan and give to the foreman, supervisor, superintendent, and the management a more definite basis upon which to discuss wage and salary rates.

In this procedure, the first steps are to devise the form on

which the worker is to make the job description, prepare the instructions for making the description, and develop a sample of such a description. Figures 12, 13, and 14 give a blank form,

FIG. 13.—SUGGESTED INSTRUCTIONS FOR FILLING OUT POSITION DESCRIPTION SHEET

Read the entire blank very carefully before writing anything. Information should be filled in only after thoughtful consideration. Follow the instructions given below as accurately as possible. After you have completely filled in all information return the blank to your Foreman (Dept. Head). If you have any comments or suggestions regarding your work, put on back of blank.

Heading:

Fill in name and date.

After "Position" give as descriptive a name as possible. For example—Special Order Clerk, not just Clerk.

Fill in the name of your department, division, and section, and the names of your Foreman, Department Head, Division Head, and Immediate Supervisor.

Item 1. Duties:

In describing your work:

Begin each statement with a word which denotes action. For example: "Open mail," "Type form letters," not "I open mail" or "I type."

Be definite, clear and concise. Whenever practical, make each statement tell as much as possible by stating kind of work, machine used, and purpose of work. For example: Check salary statements on comptometer for bookkeeper.

Attach to sheet all forms used. Refer to forms by name of form and number.

A. Daily duties.

If routine, give items in order in which they are performed. If not routine, state in order of time spent on each.

B. Weekly or monthly duties:

Give items in order of time devoted to each.

C. Occasional:

State here any duties which you may do during extra time or which may occur during irregular intervals.

Item 2. Equipment or machinery used: insert names of any machines which you use, or upon which you work.

Item 3. State number of people, if any, supervised, and give their positions.

Item 4. If you come in contact with the public or members of other departments, state whether by telephone, personally, or by correspondence.

instructions, and a sample description developed from those used by the Socony-Vacuum Corporation¹ and the Westinghouse Electric and Manufacturing Company.¹

The Time Study and Standards Department of the B. F.

¹ For a description of the Westinghouse forms see article by E. B. Roberts, "Position Description and Classification," *The Management Review*, July, 1935; and for the forms of the Socony-Vacuum Corporation (formerly the Standard Oil Company of New York) see J. E. Walters, *Applied Personnel Administration*, New York, John Wiley & Sons, 1931, pp. 153, etc.

FIG. 14.—SUGGESTED SAMPLE DESCRIPTION OF POSITION

Position:	Supervisor	Grade:	
Department:	Accounting	Division:	Cash, Ledgers,
Number in position:	1		Plant
Hours:	Regular	Sex:	Male
Duties:			

1. General:

Under general supervision do routine and some non-routine work in connection with supervising and assisting in matters pertaining to the Ledgers, Plant, and Cash Divisions of Department; and assisting the Manager and Chief Clerk as required. Work includes approving Cash Warrants and Journal Vouchers, and checking receipts, remittances, settlements, and statements.

2. Detail:

Daily:

Approve Cash Warrants.

Approve Journal Vouchers, affecting the Ledger, Plant, and Cash Divisions.

Check Cash Receipts and Remittances.

Handle correspondence relative to above records with Foreign Stations.

Take care of telephone requests.

Handle sundry matters as required.

Periodic:

Make weekly work report (Status of Division Work).

Make monthly desk inspection.

Check monthly settlement.

Check monthly Cash Disbursement Statement (Accounting Department)

Check monthly Remittance Statement.

Assist in the following:

Profit and Loss—Semi-annual #3 statement—Balance sheet analysis

" " #1 " —General semi-annual closing requirements

Occasional:

Assist Manager and Chief Clerk as required.

Equipment Used: Ediphone

Supervision of others: 11: Cashier, General Ledger, Assistant Cashier and Invoice Clerk, Ledgers #1, #2, #3; Plant Ledgers #1 and #2; two typists.

Contacts:

With Public: By correspondence.

With Other Departments: By correspondence and telephone.

Goodrich Company makes the job analyses. In this company an analysis covers the following points or factors:¹

A description of the job.	Supervision exercised by the operator.
Judgment required by the operator as to the quality of the product.	Responsibility for material and quality.
Responsibility for equipment.	Manual dexterity.

¹ H. Resseger. "Job Analysis and Classification of Operations." *Personnel*. May, 1935.

Physical requirements.
Working conditions.
Learning period.

Hazards.
Educational requirements.

The United States Gypsum Company uses the form shown as Fig. 15. This form is used for rating the job and is not applied to the individual on the job. The score for each rating is given at the top of the job rating blank.

In the generalized job description and evaluation procedure, after the job descriptions have been made by the workers and the foreman and edited by the personnel department, and evaluations have been developed by the industrial engineer, the positions can be arranged from the lowest to the highest and grouped according to the types and the responsibilities involved, and the salaries paid. From these groupings, salaries which are too high or too low can be seen readily and adjustments made, and the organization chart of the company can then be built up, based upon the facts found.¹

In a procedure such as the one described here the information is obtained from the employee and checked by the department head. It is studied impersonally and evaluated in terms of other positions and not according to personalities. The grouping of positions is based upon fact with a standard minimum and maximum determined for salaries actually paid. The value of the job is based upon a more systematic and definite evaluation procedure. The department head's attention is focused upon the detailed work of each employee, and improvement usually results. Promotion and transfers are more easily facilitated. The organization is more definitely and solidly established. Grievances because of salaries which are out of line owing to personal favoritism are prevented. The employment department has a more definite basis for employing a man in the job which is clearly described.

In general, the whole organization should run more smoothly because it is described more systematically and evaluated more scientifically.

TIME AND MOTION ECONOMY

Time and motion economy has been defined in a number of ways. Frederick W. Taylor, the father of scientific management,

¹ For an example of an organization chart and group key sheets developed by this procedure for the Westinghouse Electric and Manufacturing Company, see E. B. Roberts, *op. cit.*, pp. 207, etc.

FIG. 15.—JOB RATING

United States Gypsum Company
R. H. Macallister, Employment Supervisor

Name of Job..... Department.....

Description.....

Date..... Rated by.....

Factors	0	1	2	3	4	5	Score
---------	---	---	---	---	---	---	-------

A. JOB REQUIREMENTS
WHAT MUST BE DONE

Complexity of work 1. Manual	None	Simple	Semi- complex	Complex	Very complex	Extremely complex	.....
2. Complexity of work Mental	"	"	"	"	"	"	
3. Volume of work	"	Extremely small	Noticeably small	Moderate	Large	Extremely large	.....
4. Care and exactness	"	Un- important	Semi- important	Important	Noticeably important	Extremely important	.....
5. Confidential work	"	"	"	"	"	"	
6. Hazardous work	"	"	"	"	"	"	
7. Planning of work	"	"	"	"	"	"	
8. Supervision exercised Quantity	"	3	4-10	11-20	21-50	51 up	.....
9. Supervision exercised Quality	"	Simple	Semi- complex	Complex	Very complex	Extremely complex	.....
10. Public contact	"	Unim- portant	Semi- important	Important	Noticeably important	Extremely important	.....

B. WHAT THE JOB REQUIRES
THE WORKER TO BE

1. Age	None	17 or below	18-21	22-26	27-32	33 up	.....
2. Physique	"	Unim- portant	Semi- important	Important	Noticeably important	Extremely important	.....
3. Dress	"	"	"	"	"	"	
4. Mental skill	"	"	"	"	"	"	
5. Character	"	"	"	"	"	"	
6. Loyalty	"	"	"	"	"	"	
7. Aggressiveness Initiative	"	"	"	"	"	"	
8. Creativeness Imagination	"	"	"	"	"	"	
9. Analytical ability	"	"	"	"	"	"	
10. Enthusiasm	"	"	"	"	"	"	
11. Personality	"	"	"	"	"	"	

C. WHAT MUST BE KNOWN

1. Education	None	8 yrs.	10 yrs.	12 yrs.	4 yrs. college	Profession technical	.....
2. Knowledge of job	"	Unim- portant	Semi- important	Important	Noticeably important	Extremely important	.....
3. General experience	"	"	"	"	"	"	

Total—

was the first to devise time study in the Midvale Steel Company in 1881. Taylor's later definition and explanation were as follows:¹

Time study is the one element in scientific management beyond all others making possible the "transfer of skill from management to men," . . . "Time study" consists of two broad divisions, first, analytical work, and second, constructive work.

The analytical work of time study is as follows:

- a. Divide the work of a man performing any job into simple elementary movements.
- b. Pick out all useless movements and discard them.
- c. Study, one after another, just how each of several skilled workmen make each elementary movement, and with the aid of a stop watch select the quickest and best method of making each elementary movement known in the trade.
- d. Describe, record, and index each elementary movement, with its proper time, so that it can be quickly found.
- e. Study and record the percentage which must be added to the actual working time of a good workman to cover unavoidable delays, interruptions, minor accidents, etc.
- f. Study and record the percentage which must be added to cover the newness of a good workman to a job, the first few times that he does it.

(This percentage is quite large on jobs made up of a large number of different elements composing a long sequence infrequently repeated. This factor grows smaller, however, as the work consists of a smaller number of different elements in a sequence that is more frequently repeated.)

- g. Study and record the percentage of time that must be allowed for rest, and the intervals at which the rest must be taken, in order to offset physical fatigue.

The constructive work of time study is as follows:

- h. Add together into various groups such combinations of elementary movements as are frequently used in the same sequence in the trade, and record and index these groups so that they can be readily found.
- i. From these several records, it is comparatively easy to select the proper series of motions which should be used by a workman in making any particular article, and by summing the times of these movements, and adding proper percentage allowances, to find the proper time for doing almost any class of work.
- j. The analysis of a piece of work into its elements almost always reveals the fact that many of the conditions surrounding and accompanying the work are defective; for instance, that improper tools are used, that the machines used in connection with it need perfecting, and that the sanitary conditions are bad, etc. And knowledge so obtained leads frequently to

¹ Subcommittee on Administration of the A.S.M.E. "The Present State of the Art of Industrial Management." *Trans. A.S.M.E.* Vol. 34. Pp. 1199-1200.

constructive work of a high order, to the standardization of tools and conditions, to the invention of superior methods and machines.

Motion study, or micromotion study, was first developed by Frank B. and Lillian M. Gilbreth.¹ They defined motion study as follows:¹

Motion study consists of dividing work into the most fundamental elements possible; studying these elements separately and in relation to one another; and from these studied elements, when timed, building methods of least waste.

A definition to include both time and motion study is given by Professor R. M. Barnes of the University of Iowa as follows:²

Time study is the analysis of the methods, materials, tools, and equipment used, or to be used, in the performance of a piece of work; the development of the most economical way of doing this work; the standardization of these methods, materials, tools, and equipment; and the accurate determination of the time required by an average man to do it.

The purpose of time study during the earlier years of its existence was commonly conceived to be the setting of wage rates or the determination of a standard time to do work upon which rate setting could be based. In later years, it has acquired a new conception—stating, analyzing, and solving work problems, as well as a technique of measurement.³

Today the aims or purposes of time and motion study have come to be as follows:

1. Measurement of work for rate setting.
2. Reduction of the effort or energy in performing work, and decrease of the fatigue involved.
3. Discovery of the most efficient method, or the *one best way*, of doing work.
4. Reduction of the cost of production, or the increase of production.
5. Increase of the workers' wages.
6. Teaching of correct motions and methods to the workers, and the training of foremen and workers to be motion-minded.

¹ Frank B. and Lillian M. Gilbreth. *Applied Motion Study*. New York: Sturgis & Walton Co. 1917. P. 43.

² R. M. Barnes. *Motion Study*. Iowa City, Iowa: University of Iowa. 1933. P. 1

³ Lillian M. Gilbreth. "Motion Study," *Handbook of Business Administration*. New York: McGraw-Hill Book Co. 1931. P. 628.

7. Improvement of skill, interest, and enjoyment in doing work.
8. Improvement of the quality of the product.
9. Production of products at the right time.
10. Solving of work problems.

An expert tennis player makes his strokes in a highly skilled manner with the least possible effort, the greatest skill, and great enjoyment. If he makes his strokes expertly, he derives greater satisfaction than he does if he makes them poorly. Likewise in industry, with an increase in efficiency and skill there usually goes an improvement of interest in the work, and, thereby, a decrease in fatigue, and an increase of enjoyment in doing the work. Almost everyone really enjoys doing his work most skillfully or efficiently. Then if time and motion study can improve work efficiency and skill, it should automatically decrease the fatigue and increase the interest and enjoyment in doing the work, and, in the end, make the worker happier in his employment. This is quite the contrary to the common conception of time and motion study, i.e., that it will make the worker more of an automaton, increasing the monotony of the work to the point that he will lose interest in the job.

The purposes of time and motion study are accomplished by the following procedures:

1. Question the job, each element of the job, and the method, material, tools, and equipment used or to be used in doing the job.
2. Make a *process chart* of the work.
3. Select operations for further study, analyze each operation, and break it up into its elements, or therbligs.
4. Apply the principles of motion economy.
5. Apply stop watch or micromotion methods to the times of each element by the use of a stop watch, or by making a motion picture of the operation from which the times can be obtained; and further improve the methods of doing the work.
6. Make a simultaneous motion (*simo*) chart of the operation.
7. Standardize the work, and prepare job specifications or standard practice instructions for doing the job.

Questioning the Job. The first procedure in making a time and

motion study is to question the job and every element of the job with such questions as the following:

Why should the work be done?

What is to be done?

How is the work to be performed?

Who is to do the work?

Where is the work to be done?

When is the work to be done?

Is the work necessary? Is each individual element necessary?

Can the operation be eliminated?

Can the work be simplified?

Can the job or any element be combined with some other job or element?

Can the sequence of the operation be changed?

Is the life of the job sufficiently long to make a time and motion study worth while?

What are the various possible ways in which the job or therbligs might be done?

Time and motion study experts usually prepare extensive questionnaires with all possible questions to insure against overlooking any important factors. A sample of some of the most common questions is given in the *Cost and Production Handbook*.¹

The Process Chart. After the job and its various elements have been questioned, a process chart is

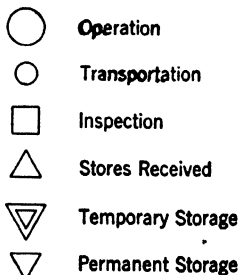


FIG. 16.—Process chart symbols. (Abbreviated set.)

made of the work. This involves the making of a chart of the flow of the work and materials from the time they enter the plant until they leave as a finished product. The process chart gives the sequence of the process and visualizes it as a means of improving it. Symbols have been devised for that purpose. The abbreviated process chart symbols are given in Fig. 16. The process flow charts, Figs. 17 and 18, show the application of these symbols to the manufacture of a coil spring. Figure

17 shows the old method before a time and motion study was

¹L. P. Alford (ed.). *Cost and Production Handbook*. New York: Ronald Press Co. 1934. P. 535.

Name of Therblig	Ab- bre- viation	Definition	Mnemonic Symbol	Explanation of Symbol	Color	Color Symbol	Pencil No. (Dixon)
Search	Sh	Eyes or hands are feeling or groping for object.		Eyes turned as if searching.	Black		331
Find	F	A mental reaction at end of search, and before select.		Eyes straight as if fixed on object.	Gray, heavy		352 1/2
Select	St	The choice of one object from among several.		Reaching for object.	Gray, light		352 1/2
Grasp	G	Taking hold of an object; closing the fingers around it.		Hand open for grasping object.	Lake red		321 1/2
Transport loaded	TL	Moving of an object from one place to another; change of location.		A hand with something in it.	Green, heavy		354
Position	P	Turning or locating an object so that it can be fitted into its intended location.		Object being placed by hand.	Blue, heavy		350
Assemble	A	Placing one object into or onto another object of which it is an integral part.		Several things put together.	Violet, heavy		323
Use	U	Consists of manipulating a tool, device, or piece of apparatus for the intended use.		Word "use".	Purple		323 1/2
Dis-Assemble	DA	Separating one object from another object of which it is an integral part.		One part of assembly removed.	Violet, light		323
Inspect	I	Testing an object for compliance with standards.		Magnifying lens.	Burnt ochre		335 1/2
Pre-position	PP	Positioning an object in a predetermined place.		A nine-pin which is set up in a bowling alley.	Sky-blue, light		320
Release load	RL	Letting go of an object.		Cropping content out of hand.	Carmine red		321
Transport empty	TE	Moving the empty hand in reaching for an object.		Empty hand.	Green, olive or light		325
Rest	R	Fatigue or delay factor or allowance provided for recovery from fatigue incurred by work.		Man seated as if resting.	Orange		324
Unavoidable delay	UD	Failure or interruption in process; arrangement preventing one part of body from working.		Man bumping his nose, unintentionally.	Yellow ochre		324 1/2
Avoidable delay	AD	Delay for which the operator is responsible and over which he has control.		Man lying down on job voluntarily.	Lemon yellow		353 1/2
Plan	Pn	Mental reaction preceding physical movement; deciding how to proceed with the work.		Man with fingers at brow, thinking.	Brown		343
Hold	H	Retention, without movement, of object after grasping.		Carpenter's vise.	Lake red		321 1/2

FIG. 19.—Therblig chart. (With names, abbreviations, definitions, symbols, and explanations.)

made. After each step in the process was studied, analyzed, and questioned, and every unnecessary step eliminated, a new method was devised as shown in Fig. 18, with a saving of 3,756 feet of travel and 17 operations.

The process flow chart enables one to see the details in themselves and in relation to each other and to the whole. It should show the *make ready*, the *do*, and the *put away* of the job. It gives a general view of the whole process as well as the individual steps in the flow of the processes. The process chart should be devised to show the distance traveled by the materials used and the operator, as well as the steps in the sequence and the time taken to perform each step and the whole process.

Analysis of the Operation. After the whole process of the job has been studied, the time and motion analyst selects the operation to be investigated more minutely, and then proceeds to study each actual operation itself. He first divides the operation into motion cycles and then again the motion cycles into elements called "therbligs."¹

The therbligs were first analyzed, devised, and defined by Mr. Frank B. Gilbreth. They are shown in Fig. 19 with their names, symbols, abbreviations, and definitions.

When the operation is to be studied, either by the stop watch or moving-picture method, it is usually advisable to make an analysis of the operation before time and motion study methods are applied, in order that the savings resulting from the study can be easily shown by comparing the study before and after making.

The operation to be studied is analyzed and divided into its therbligs, with the times being taken at the beginning and end of each therblig. Figure 20 shows the therbligs and their times of the right and left hands for the assembling of three washers on a bolt (old method). When the operation or job is divided into its therbligs the principles of motion economy are then applied.

Principles of Motion Economy. In his wide experience in studying hundreds of different operations, Mr. Gilbreth developed certain rules or principles of motion economy, which have since been elaborated upon by many industrial engineers, among

¹ "Therblig" is Gilbreth spelled backwards with a slight variation. It was devised by Mr. Gilbreth because no adequate word was available.

them Dr. Lillian M. Gilbreth, A. H. Mogensen, Professor R. M. Barnes, and the Charles E. Bedaux Company. These four sets of principles of motion economy have been studied in detail, and the composite set of principles of motion economy, Table V, has been derived in the form of a check list.

Each one of these rules, in turn, is applied to the operation. Not all of them can be used on every job, but the consideration of all of them in the check list guarantees that no usable prin-

						Film No. X80					
Operation Assemble Three Washers on Bolt						Operation No. A32					
Operator's Name & No. M.S.Bowen No. IC4						Date of Analysis 1-28-32					
Analyzed by S.M.M.						Number of Sheets 1					
						This Sheet No. 1					
Clock Reading	Subtracted Time	Therblig Symbol	LEFT HAND Description	Clock Reading	Subtracted Time	Therblig Symbol	RIGHT HAND Description				
318	8		Carries assembly to left	318	23		Moves hand to lock washers				
326	4		Releases assembly	341	9		Searches & grasps washer				
330	5		Moves hand to bolts	350	8		Carries washer toward bolt				
335	3		Searches & grasps one bolt	358	4		Positions washer				
338	20		Carries bolt	362	11		Assembles lock washer				
358	4		Positions bolt	373	8		Moves hand to steel washers				
362	95		Holds bolt	381	12		Searches & grasps washer				
457				393	9		Carries washer toward bolt				
				402	3		Positions washer				
				405	8		Assembles washer				
				413	12		Moves hand to rubber washers				
				425	4		Searches & grasps washer				
				429	11		Carries washer toward bolt				
				440	4		Positions washer				
				444	11		Assembles rubber washer				
				455	2		Releases finished assembly				
				457							

FIG. 20.—Analysis sheet for bolt and washer assembly—old method. (From: R. M. Barnes, *Motion Study*. P. 28.)

ciple has been omitted for the improvement of the operation being studied.

As an example of the application of these rules, let us consider the first principle of confining the motions to the lowest possible classification. A worker can work with the least amount of effort in the lowest classifications of motions. If arcs were drawn with the right and left hands, the elbows comfortably close to the body, the working area (A, Fig. 21) in front of the body and within those arcs would probably be the best normal working area for that individual. The next best area would probably be in front of the body within the two arcs

TABLE V
PRINCIPLES OF MOTION ECONOMY

The following principles of motion economy are applicable to various types of work. Not all these principles are applicable to every job or operation, but they can be used as a basis for improving the efficiency of work. Check each principle at the right for each job study in order to make certain that that principle has been applied to that study or considered with reference to it. References are given at the end of the list of principles. A-1 after a principle means that that principle is also found as the first principle in reference A; C-2 refers to the second principle in reference C, and so on.

1. Motions should be confined to the simplest possible division of the following classification:

- (1) Finger motions.
- (2) Finger and wrist motions.
- (3) Finger, wrist, and lower arm motions.
- (4) Finger, wrist, lower arm, and upper arm motions.
- (5) Finger, wrist, lower arm, upper arm, and body motions.

Arrange the work so that finger or hand motions will suffice, if possible, the arms and body being brought into play only as a last resort. (B-5; C-12; D-3).....

2. Motions of the arms should be in opposite and symmetrical directions, and should be made simultaneously. (A-5; B-4; C-4; D-1).....

3. Both hands should begin and complete their same therbligs simultaneously. (A-1, 2; B-1, 2; C-1, 2; D-1).....

4. Definite and fixed stations should be provided for all materials; tools and light equipment should be pre-positioned wherever possible to reduce the *search*, *find*, and *select* therbligs. (B-20; C-17; D-14).....

5. Tools and materials should be located so as to permit the best sequence of therbligs. They should be placed around the work-place so that they may be grasped in the working position at a point nearest to their place of use. (B-9, 19; C-14; D-5).....

6. Gravity-feed containers should be used to deliver the material as close to the point of assembly or use as possible. This delivery point should be near the height at which the assembly is made in order to eliminate any lifting or change of direction in carrying the parts to the assembly. (B-18; C-18).....

7. Ejectors should be used to remove finished parts. (C-19).....

8. "Drop deliveries" should be used whenever possible. Tools and finished work should be dropped or thrown when the nature of the work permits. (B-17; C-20; D-7, 12).....

9. The hands should be relieved of all work that can be transferred advantageously to other parts of the body. (B-16; C-16; D-10).....

10. Do not use hands to guide, brace, or hold work or tools when an economical substitute in the form of a jig or brace can be made or used. (D-8, 11).....

11. The number of therbligs required to do work should be counted, for the best way is almost always a sequence of the fewest therbligs. (A-8; B-10; C-7).....

12. It is usually quicker to transport small objects by sliding than by carrying. (B-6; D-4).....

13. A "full-hook" grasp is usually quicker than a "pressure" grasp. (B-7).....

14. Material or tools may be more quickly grasped when fully separated from adjacent objects. (D-13).....

15. Weight and momentum should be employed to assist the worker wherever possible, and they should be reduced to a minimum if they must be overcome by muscular effort. (B-15; D-9).....

16. The path of the hands should be free from jerky, jiggling motions. The work should be arranged so that the paths described are smooth and continuous. (B-11; D-6).....

TABLE V—Continued

17. A sequence of motions should be arranged to build rhythm and automaticity into the operation. (A-15; B-13; C-15).....	_____
18. Free, loose (ballistic) movements are faster, easier, and more accurate than restricted (fixation) or "controlled" movements.	_____
19. Where each finger performs some specific movement (such as in typewriting), the load should be distributed in accordance with the inherent capacities of the fingers. (B-14).....	_____
20. The two hands should not be idle at the same time except during rest periods. (A-3; B-3; C-3).....	_____
21. Hesitation must be analyzed and studied; its causes accounted for, and, if possible, eliminated. (A-6; C-5; D-17).....	_____
22. Levers, cross-bars, and hand wheels should be located in such position that the operator can manipulate them with the least change in body position and with the greatest mechanical advantage. (B-22; D-16).....	_____
23. Handles for tools and cranks should be made large so as to take advantage of the leverage and comfort given by them. (B-21; D-15).....	_____
24. A chair of the proper type and height to permit good posture should be provided for every worker possible. (B-24).....	_____
25. The height of the work place and the chair should preferably be arranged so that alternate sitting and standing at work is easily possible. (B-23).....	_____
26. Use the fewest motions possible for a given result. Question each element as to its necessity. Can the job be done without it? Could a rearrangement of motion sequence reduce the number of elements? (D-19).....	_____
27. Every instance where delay occurs suggests the advisability of providing some optional work that will permit utilizing the time of delay. (A-10; C-9).....	_____
28. The shortest time demonstrated in one part of a study should be used as a mark to attain and reasons for other times required in other parts should be known. (A-7; C-6).....	_____
29. Variations of time required for any one therblig should be arrayed and the causes recorded. (A-11; C-10; D-18).....	_____
30. The best sequence of therbligs in one kind of work is often useful in suggesting the best sequence in other kinds of work. (A-9; C-8).....	_____
31. There is a fairly definite time range in which each of the therbligs should be performed. Though this differs for different people, correct standards from which to deviate should be established. (A-4; B-8).....	_____
32. Lateness of various parts of the anatomy as compared with other portions should be recorded. (A-12; C-11).....	_____
33. Lateness of anatomical members of experts should be observed most carefully. Where it is not possible to work from the first at the speed of an expert, this lateness should be copied as closely as possible. (A-14).....	_____
34. Since fast motions cannot be made in the same path as slow motions, the learner will acquire desirable automaticity most quickly if he works at motion speed of the expert from beginning, regardless of quality of resulting work. (A-13).....	_____
35. Awkwardness, grace, and ambidexterity are all greatly affected by the time element, which affects also hesitation and decision, and many other psychological variables. (A-16).....	_____

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New York: *Factory and Industrial Management*, McGraw-Hill Book Co. 1932. P. 98.

(D) *Methods and Techniques Used in Photographing and Analysing Operations*. New York: Production Control Machines Corporation. 1935. P. 9.

made by the hand fully outstretched, without moving the body. Figure 21 shows graphically the normal and maximum working areas.

The application of all these principles should result in economy of motion, a saving in time and energy, improvement in skill, and in general increased efficiency of doing the work. After they have been applied, the times of each element or therblig can be taken, studied, and again improved. This can

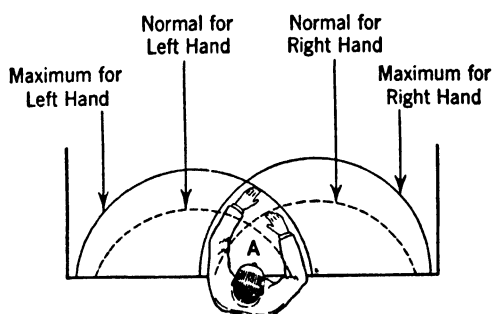


FIG. 21.—Normal and maximum working areas.

be done by two methods, the stop-watch method or the micro-motion method.

Stop-watch Method. About 80 per cent of the 388 companies studied by the National Industrial Conference Board in 1935 had a central time study department, with a specialist to make the studies.¹ In 17 per cent of the companies the foremen made these studies. However, this did not involve a detailed time and motion study analysis, for only 19 per cent of 528 companies made such studies; 40 per cent made a time study analysis without the application of the principles of motion economy. For the time study analysis, the procedure involves dividing the operation into its elements or therbligs and taking the time it takes to perform each. Usually ten complete cycles of the operation are timed, the average or modal times being used. The arithmetical average for the elements in the ten cycles is the

¹ National Industrial Conference Board. *Financial Incentives*. New York. 1935. P. 23.

most frequently used. The modal time—that which occurs the most frequently—is perhaps more satisfactory. However, we should try to make conditions best for the best and shortest times.

The first procedure in making a time and motion study is to select the right operator or operators to study. If only one operator is to be selected, the most intelligent one, the one from whom the best results can be expected, should be selected. The operator who is more highly skilled is usually more consistent and systematic and has the best attitude. He may also be able to make good suggestions and understand the idea of the study more readily and easily. However, it is not safest to depend on one operator. Several should be selected and the best parts of each study chosen.

The time and motion study man should explain carefully, diplomatically, and in an open and frank method, what he is doing.

Even though the times should be leveled to that of the average worker, they should be taken on the best workers to discover or provide the best methods.

The equipment used is principally a stop watch attached to a board upon which the time study record is placed. The dial of the stop watch is usually divided into 100 equal spaces, each of which represents $1/100$ of a minute, and the hand makes one complete revolution per minute. A smaller dial is divided into 30 spaces, each representing one minute of time. Watches of other divisions, such as the hour decimal watch, are also used. R. M. Barnes¹ has devised a time study board with two minute-decimal stop watches which are linked together in such a way that the starting of one watch stops the other, and vice versa. This permits the times being taken exactly, without the necessity of snapping back the hand at the beginning of each element of an operation. The John Deere Plow Works of East Moline, Illinois, has developed, made, and now uses double-watch time study devices.

From the average or modal times for each element the total time can be obtained and checked with the continuous time observed from the beginning to the end of the operation.

While the times are being taken the time study analyst judges:

¹ R. M. Barnes, *Industrial Engineering and Management*. New York: McGraw-Hill Book Co. 1931. P. 128.

(1) the skill or speed, (2) the effort as poor, fair, average, good, excellent, or superexcellent, (3) the conditions from poor to ideal, and (4) the consistency from poor to perfect. From these ratings he standardizes the times, as a rule, to the accomplishment of the average worker. Of the 515 companies investigated in 1935 by the National Industrial Conference Board, 63 per cent based their performance standards on the expected accomplishment of the average worker, 38 per cent upon the expected accomplishment of the thoroughly trained and experienced worker, and fewer than 2 per cent on the expected accomplishment of the exceptionally effective worker.¹

Upon leveling or standardizing the times and elements of the operation, the labor costs for each element and each operation can be determined, and can be used in cost analysis and determination. In many companies the times of a job are not taken until after the principles of motion economy have been applied. After the job has been so improved, the times are taken and both the times and motions of each element are recorded and standardized. Figure 22 gives the form and figures of a stop-watch time study made by the Delco-Remy Corporation.

Motion or Micromotion Study Methods. In some companies in recent years motion pictures have been made of the operation before and after the principles of motion economy have been applied. To do this a standard 16-mm. or 8-mm. camera, with adequate lights to prevent glare and shadows, is used to photograph the operation, with a microchronometer in view. The microchronometer is a specially developed clock with the face divided into 100 divisions. One hand makes 20 revolutions per minute. This facilitates the timing of an element or therblig to 1/2000 of a minute. In recent years the cameras have been so developed that the speed of the film is sufficiently uniform to permit the calculation of times of each therblig directly from the film as it is run frame by frame, or continuously.² These cameras usually run at a speed of 8 to 72 frames per second.

After the picture is made, a simultaneous motion (simo) chart

¹ National Industrial Conference Board. *Op. cit.*

² The Production Control Machine Corporation, of New York City, has devised a camera with an electric motor attachment to make pictures with a uniform speed per frame, and the times of the elements can be taken directly from the films. Also, some companies now find the regular commercial cameras adequate for this work.

TIME STUDY SUMMARY DELCO-REMY CORPORATION

EQUIPMENT

Type #4 Warner & Slawson		DR No. 10319		Part No. 113397		Oper. No. 40		Model 9564		Dept. 403	
Machines per Operator 2		Spindles		Strokes		Part Name		Communication End Frame			
Location of Work On Machine Bed						Operation		Drill 3/16" Dia. - Co. Bore & Finish Face End			
Material Cast Iron		Shearing Spec.				4 Beam		Shift Hole on #4 and Hand Screw			
Source of Supply Operator's Gate Stock						12091 B - 11379.0 B1-2					
Spindle		Dia.		Sur. F. P. M.		In Feed Per Rev.		Min.		Type Tools	
4 450		1"		117'		.018		F. 4		1" Co. Drill	
6 450		1.300		153'		Hard feed		1/16"		1/2" Drilling Tool	
7 450		1.055		118'		.018		F. 4		1/32" 2 1/2"	
9 450		1.300		153'		Hard feed		1/16"		1/2" Drilling Tool	
10 85		1.063		23'		Hard feed		.005"		2 1/2" 1.063" Reamer	
Accur. Ret'd		Length		Cut		Depth		2 1/2"			
4 450		1"		117'		.018		F. 4		1" Co. Drill	
6 450		1.300		153'		Hard feed		1/16"		1/2" Drilling Tool	
7 450		1.055		118'		.018		F. 4		1/32" 2 1/2"	
9 450		1.300		153'		Hard feed		1/16"		1/2" Drilling Tool	
10 85		1.063		23'		Hard feed		.005"		2 1/2" 1.063" Reamer	
Mach. Time 34.4		@ 100 %		34.4		Hand Time 20.7		@ 100 %		20.7	
Class of Oper.		Male		Female		Date Effective		Follow-up		Former Standard	
Savings		Increase		Allowed Point Hour		Total Net Actual Time		Hourly Production		Standard	
66.2		90		54		66.2		1.655		1.655	
Reference Information - Part		Master for Parts		821295 - 1837910 - 1845919		Oper. No.					
Reason for Change or Remarks:											
Lubrication Dry											
Remarks:											
Observer		O. K. T. S. Supervisor		O. K. Dept. Foreman		O. K. Div. Supervisor					
Sig. E. L.		Attested		O. K. Foreman		O. K. Div. Supervisor					
Date 5/12/34											

FIG. 22.—Time Study Summary, Delco-Remy Corporation.

can be prepared. The *simo chart* is a device for the visualization¹ of:

- (a) The various members of the body engaged in performing the operation.
- (b) The simultaneity of the different motions made by the different members of the body.
- (c) The motions and elements of motions used by these various members.
- (d) The relative and actual times consumed by each element of a motion.

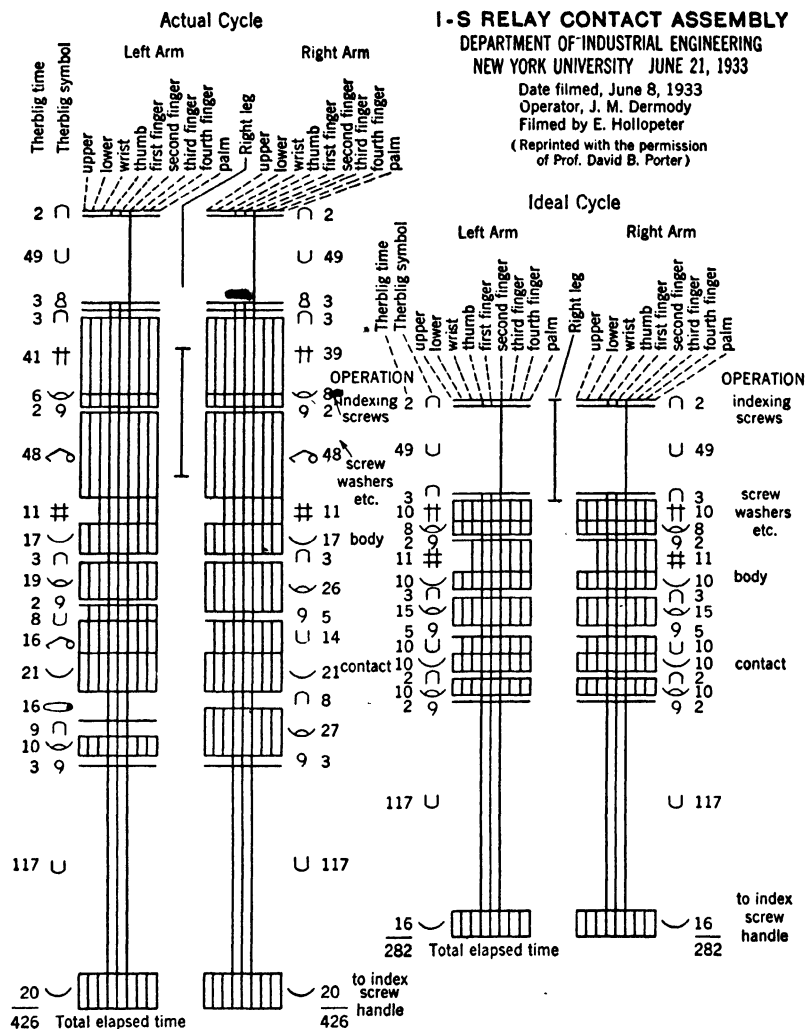
At the top of the chart the parts of the body, usually the right and left hand, are listed with the times recorded on the chart for each therblig of each hand as the work progresses and as taken directly from the film. Figure 23 is an example of a simultaneous motion chart prepared by Professor David B. Porter of New York University.

From a study of the simo chart, the film, or the stop-watch analysis, the elements are standardized and standard practice instructions for doing the work can be prepared. Figure 24 shows the form used by the General Electric Company (Fort Wayne, Indiana) to make a time and motion study; it gives the standard practice instructions which resulted from a motion study of the assembly of a mounting spring for a refrigerator.

By taking a stereoscopic picture of an operation against a cross-sectioned background with a minute electric light bulb attached to the hand or other moving part of the worker's body, the path of the motions can be determined, and from those paths a cyclegraph can be studied to decrease, improve, and record the motions.

Results of Time and Motion Study. Perhaps the best way of proving the results of time and motion study is by giving tangible savings in times or the increases in production of different jobs upon which time and motion studies have been made. The General Electric Company at Fort Wayne made the following savings in time on these jobs which they studied:

¹ Frank B. and Lillian M. Gilbreth. *Motion Study for the Handicapped*. London: George Routledge & Sons, Ltd. 1920. Pp. 29-30.

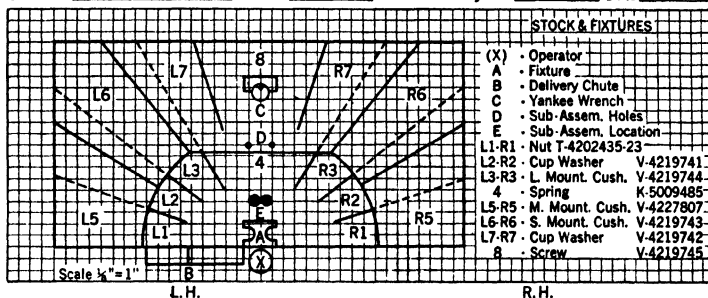


*Savings in
time, per cent*

- | | |
|---|------|
| 1. Assemble leads in commutator..... | 30 |
| 2. Remove insulation from wire..... | 72 |
| 3. Assemble lead to current coil spool..... | 78.6 |
| 4. Soldering lead to electric static shield..... | 51 |
| 5. Assembly of synchronous motor shaft..... | 71 |
| 6. Wrapping stripped end of lead..... | 87 |
| 7. Assemble primary and plate coils and wrapper in two operations.... | 59 |

Dept. REFRIGERATION Operators Instructions
 Dr. T-4202435 Name of Part MOUNTING SPRING ASSEM. Ser. No. 5-1000
 Operation ASSEMBLY OF MOUNTING SPRING ASSEMBLY FOR DOMESTIC REFRIGERATOR

Observer M.L.H. - L.P.P. Date 3-13-36 Time Study No. NONE Date NONE



- | | | |
|--|--|--|
| <p>Get and place "slide" nuts in fixture A.</p> <p>Get and place "slide" large cup washers in fixture A.</p> <p>Get and place large mounting cushions on bench at location E.</p> <p>Get and position springs on mounting cushion at location E.</p> <p>Place springs and mounting cushions in fixture A.</p> <p>Get and position medium mounting cushions on springs.</p> <p>Get and place small mounting cushions in assembly position in holes D on upper deck in front of operator.</p> <p>Get and place small cup washers on small mounting cushions in holes D.</p> <p>Get and place screws thru assemblies in D, retain hold and place sub-assemblies on assemblies at A and transport screws to nuts.</p> <p>Grasp, position and hold Yankee wrench on screw head.</p> <p>Transport wrench to other assembly position and hold wrench on screw head.</p> <p>Remove assemblies from fixture and dispose in drop delivery chute.</p> | <p>1.</p> <p>2.</p> <p>3.</p> <p>4.</p> <p>5.</p> <p>6.</p> <p>7.</p> <p>8.</p> <p>9.</p> <p>10.</p> <p>11.</p> <p>12.</p> | <p>Get and position Yankee wrench on screw and assemble screw in nut. (4 downward and 4 upward shoulder movements)</p> <p>Transport and position Yankee wrench on screw and assemble screw in nut. (4 downward and 4 upward shoulder movements)</p> <p>Transport Yankee wrench to holder and position in holder.</p> |
|--|--|--|

FIG. 24.—Operators' instructions and job description of the General Electric Co., Fort Wayne, Indiana; L. P. Persing in charge of time and motion study.

8. General view of the complete assembly of the mite meter mechanism. 66
9. Assembling the mite meter cam shaft. 44
10. Assembling the M-20 demand meter registers. 70.4
11. Assembling M-21 clutch shaft. 46
12. Spraying D-30 and D-35 refrigerator units. 50.6
- Savings in paint for one year were \$5,974.00
- Direct labor savings were. \$3,750.00

Examples of improvements in other companies are as follows:

	<i>Per cent</i>
Terminal block assembly	
Reduction in cost.....	46.8
Increased production.....	84.6
Stud and plate assembly	
Increased production.....	82
Burring small parts.....	45
Stamping links.....	60
Drilling ~~spring~~ pipes.....	37

The General Electric Company at Fort Wayne have 101 time study and planning engineers who devote full or part time to this work. For a two-year period, 1930-32, 465 foremen and salaried personnel were taught how to use time and motion study methods—motion-mindedness—in their laboratories or classes. Their average saving in time on the jobs which they have studied is 38.6 per cent time take-out. In one job they saved 78.6 per cent of the time. Before making a time and motion study they consider that they can save at least 30 per cent. In one period they spent \$2,678 for making the time and motion studies and saved the company \$52,000 on old jobs, plus the savings which were effected in starting new jobs for which no comparison of cost before and after could be made.

Mr. F. A. Parkhurst¹ has calculated the work efficiency of an unskilled worker in general to be 50 per cent, and for the average skilled worker—30 per cent. This also shows the possibility of improvement still remaining in many jobs.

In most of the cases where time study methods have improved production or saved time, the wages of the employees have been increased, yet with a decrease in unit cost of production. This shows some of the tangible results of time and motion study, yet the intangible ones, such as reducing fatigue, finding the most efficient method or the *one best way* of doing work, teaching correct motions and methods or motion-mindedness, rate setting, and solving work problems may give the employer even greater employee satisfaction, good will, and loyalty to the company. Time and motion study is one way of making increased wages and decreased costs synonymous, because, while the unit cost of production is decreased the worker's wages can

¹ F. A. Parkhurst, *Manufacturing Industries*. Vol. XIV. No. 3. Pp. 173-4.

be increased. The final results of time and motion study are standard practical instructions which can be used as a permanent record of the work of each job.

There are systems or special applications of time and motion study, such as the Gilbreth System by Lillian M. Gilbreth, of Gilbreth, Inc., Montclair, New Jersey; the Bedaux System (or the Production Control Machines Corporation); and Motion-Time Analysis of A. B. Segur of the A. B. Segur Company, Chicago, and others. Most of the methods in this chapter are those developed by Frank B. and Lillian M. Gilbreth. They also form a basis for many of the others. Mr. Bedaux's method of time and motion study is that of the Production Control Machines Corporation and involves management control. Mr. A. B. Segur of Oak Park, Illinois, has developed a principle of motion-time analysis—that within practical limits the times required of all expert workers to perform true fundamental motions are constant. He has collected data on these constant times, which he contends provide a means of determining base or standard times for performing operations for the required fundamental motions.

SIMPLIFICATION, STANDARDIZATION, AND SYSTEM

An important procedure in management is the *simplification* of products and methods, so as to accomplish the intended purpose with the least amount of effort. Simplification is that policy of management which has as its object the performance of all functions in the least elaborate manner consistent with the given purpose. In an already existing company, it involves reduction of excessive varieties of types and sizes of products and methods. Simplification eliminates superfluous varieties.

In 1921 the average waste in production of six typical industries was estimated as 49 per cent; in 1929 the annual waste in distribution was calculated to be \$8,000,000,000¹ or one-twelfth of the national income at that time (about \$67 for every person in the United States). One method of eliminating this excessive waste is through simplification.

The Toledo Scales Company had at one time 12,000 different

¹ Division of Simplified Practice, United States Bureau of Standards. *Simplified Practice, Its Purpose and Application*. Washington, D. C.: Government Printing Office. April 16, 1934. P. 1.

models of scales and parts. A survey revealed that only 8 per cent of these models produced 91 per cent of the unit sales. Simplification resulted in a 49 per cent reduction of the parts originally used.

Through the cooperation of the Division of Simplified Practice of the Bureau of Standards, the paving brick industry reduced its varieties of brick from 66 to 6 at an estimated annual saving of \$1,000,000. The lumber industry reduced its varieties 60 per cent at an estimated savings of more than \$200,000,000. The steel industry reduced varieties from 819 to 209.

In a specific company, simplification starts with a survey of the number of items manufactured, the past sales, future market possibilities and the relative expense and profits of each item, the extent of interchangeability of parts, and the possibilities for standardization. After such a survey has been made, simplification can first proceed with the elimination of as many as possible of the high-cost and low-sales items. In general, the resulting benefits of simplification and simplified practices are as follows:¹

TO THE PRODUCER AND MANUFACTURER

1. Less capital tied up in slow-moving stocks.
2. More economical manufacture due to simplified inspection requirements, longer runs with fewer changes, less idle equipment, less stock to handle, reduced clerical overhead, etc.
3. More permanent employment as contrasted with present seasonal employment.
4. Larger units of production and less special machinery.
5. Prompter delivery.
6. Less chance of error in shipment.
7. Less obsolete material and machinery.

TO THE JOBBER, WHOLESALER, AND RETAILER

1. Increased turnover.
2. Elimination of slow-moving stock.
3. Staple line, easy to buy, quick to sell.
4. Greater concentration of sales efforts on fewer items.
5. Decreased capital invested in stocks and repair parts on hand.
6. Less storage space required.
7. Decreased overhead, handling charges, and clerical work.

¹ Division of Simplified Practice, United States Bureau of Standards. *Simplified Practice Recommendation R95-30*. Washington, D. C.: Government Printing Office. 1931. P. 11.

TO THE CONSUMER

1. Better values than otherwise possible.
2. Better service in delivery and repairs.
3. Better quality of product.

Seeing the great need for simplification in industry, the Department of Commerce organized an agency, the Division of Simplified Practice of the Bureau of Standards, in 1921, to cooperate with industry as a neutral, disinterested, coordinating, central agency to assist in developing the best thought and practice of simplification in industry.

The studies of the Division show that about 80 per cent of the business is done with approximately 20 per cent of the varieties in which the product is offered. The first principle adopted was that all simplification activities should be voluntary. A simplified practice must be initiated by a group in an industry, voluntarily.

The request for a simplified practice first comes from a group of manufacturers, distributors, or users of the product in an industry. A representative committee is then appointed to secure a complete list of sizes, varieties, and types of the product, the volume of each item produced, the relative importance of each item, the probable future trends, and suggested eliminations. The representatives of producers, distributors, and consumers are then invited to a general conference based upon the reports of the committee, which adopts a list of sizes and types of the product. A complete report is prepared by the Division of Simplified Practice and is submitted to those concerned for final acceptance. At the close of the general conference, a permanent standing committee is appointed composed of three representatives each, from the distributors, producers, and consumers. Simplified practices are usually reaffirmed and revised once each year. Up to April 16, 1934, the Division of Simplified Practice had cooperated in developing more than 150 completed simplified practice recommendations, to which more than 26,000 acceptances had been recorded by more than 11,000 organizations.¹

Not only can simplification be applied to existing sizes and types of products, but also it can be used advantageously in advance of the production of a new product.

¹ Division of Simplified Practice. *Simplified Practice*. P. 7.

An example of the results of a simplified practice recommendation is *R95-30* for skid platforms as follows:

<i>Clearance dimensions</i>		<i>Inches</i>
Clear height from bottom of runners or other supports to under side of platform.....	{	8
Minimum horizontal distance between inside of runners or other supports		29

Overall dimensions for platforms of skids

No. 1 skid:

Width.....	{	Not less than.....	32
Length.....		Not more than.....	33
			54

No. 2 skid:

Width.....	42
Length.....	60

Simplification may apply to a product, a method, a process, a quality, or a conception.

After simplification has been carried out, the best design, quality, method, or process for performing a desired function is determined and established in use. This function is called *standardization*. It is primarily technical and creative, and involves standards of measurement, constants, quality, performance, and practices. The most favorable varieties, the best nomenclature, the proper dimensions, proportions, and quality, adequate methods of tests, ratings, provisions of safety, rules of operation, and management standards come within the scope of standardization.¹

One of the first places where standardization occurred was with reference to the interchangeability of parts in the manufacture of different types of machinery. With proper standards the various parts manufactured could be interchanged on different machines. This led to the standardization of such products as bolts, tools, and parts, and the consideration and establishment of preferred numbers, purchase specifications, and the like. Perhaps the best examples of standardization are the engineering standards set up by the thirty-three most important technical societies represented by the American Engineering Standards Committee. Thus, the Boiler Code of the American Society of Mechanical Engineers has become the standard of all boiler construction and a legal requirement in many states.

¹ *American Standards Association Yearbook*, 1928, P. 9. (Also later Yearbooks.)

Upon the standardization of these various products, parts, functions, and methods, management can proceed to develop the proper *system* in its management procedures. System is the proper coordination of the various factors of management. From the standpoint of methods it would involve an adequate organization chart and records, job descriptions, and time and motion study, combined with the various records of performance, administrative reports, coordinating committees, orders, and returns, etc.

System may be greatly aided by the *exception* rule in management. Rules, regulations, and standards are set for all of management's procedures, and as long as the performance is maintained at those standards all matters are handled systematically by those directly responsible for them. Only those matters which vary from and are the *exception* to the standards are handled by higher management. Under this arrangement the concern operates smoothly and systematically until an exception to the standard occurs, when the matter is immediately brought before the higher executives. For example, if a department operates up to standard, the department head approves the performance. If it deviates from the standard, it comes before the higher executives. If costs exceed standards, this exception comes before the higher management.

By this principle of exceptions, management is relieved of concentrating its attention upon details and routine matters and can consider promotional policies and future plans.

SPECIAL ASSIGNMENTS

Policies

1. Report on the policies of some company or organization with which you are personally acquainted.

Organization

2. Make an organization chart of some company, department, or organization (not described in this chapter) which you know personally; and describe it briefly.

Job Description

3. Make a detailed job description of a particular job, personal or industrial.

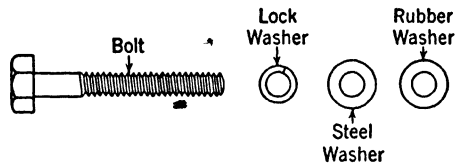
Time and Motion Economy

4. Apply the principles of motion economy to the job of shaving or dressing yourself. Give the arrangement of the layout for both old and new methods.

Carry your analysis of the steps in the operation from the time you get the materials until they are put away. Point out savings effected by timing the various steps.

5. Apply the principles of motion economy to the bolt and washer assembly.¹ The old method is given on the analysis sheet, Fig. 20. Give the therblig motions for each hand for your improved method. (The symbols and times are not required.) Make a diagram of your proposed set-up.

The parts of the assembly consist of a bolt, a lock washer, a steel washer, and a rubber washer.



The assembly by the old method involved using a tray divided into five compartments. The parts were in the compartments 2-5, and the completed assemblies were dropped in compartment 1.

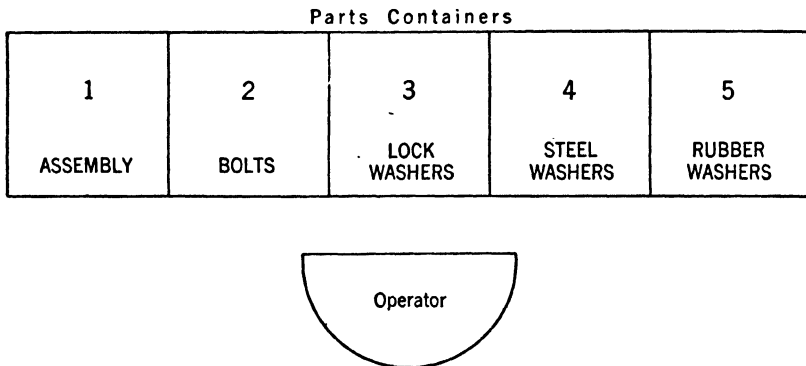


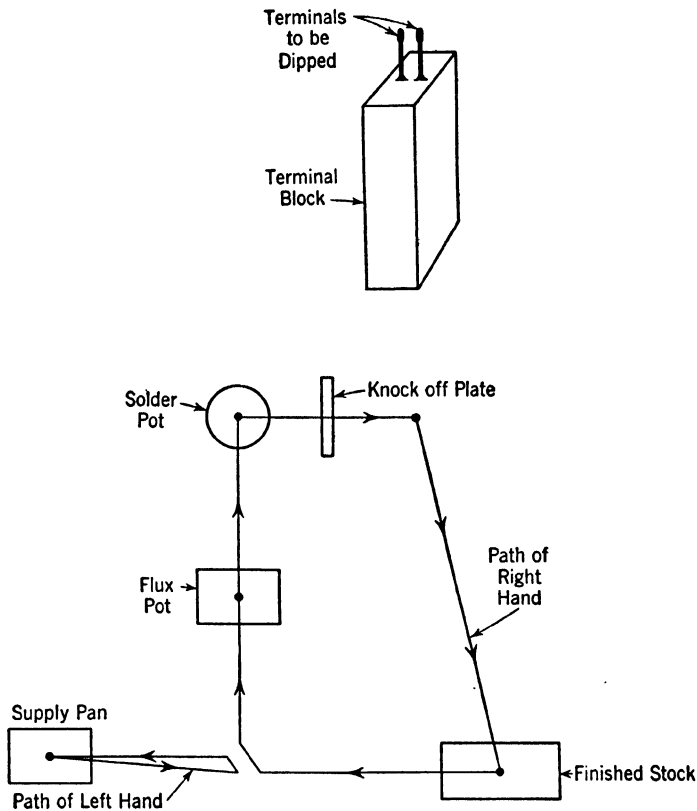
FIG. 25.—Bolt and washers assembly layout.

6. Devise a new method of increasing production of the tin-dipping of terminal blocks by applying the principles of motion economy:

The job consists of tin-dipping the terminals of a terminal block assembly,² as shown on the diagram given below, to facilitate soldering of wires to the terminals in a final assembly operation. The job is to be done manually by one operator. The blocks are too large for two to be held in one hand.

¹ This assignment was devised from a similar one used in the General Electric Company at Fort Wayne, Indiana, and R. M. Barnes, *Motion Study*.

² This assignment was devised from A. H. Mogenson, *Common Sense Applied to Motion and Time Study*, "Motion Study with the Stop Watch," by E. H. MacNiece; *Factory and Industrial Management*, 1932. P. 57.



BENCH LAYOUT OF OLD METHOD

OPERATION CYCLES OF OLD METHOD

Left hand

Pass block to right hand.

Pick block up.
Hold block.*Right hand*Receive block from left hand.
Dip terminals in flux.
Dip terminals in solder pot.
Knock off excess solder.
Toss block into stock pan.

FIG. 26.—Layout of terminal block tin dipping.

7. A considerable number of small steel angles are needed to reinforce various wood fixtures. Each leg of these angles is drilled with a $\frac{1}{4}$ -inch hole. It is necessary to burr or countersink these holes so that the heads of screws will come flush with the surface of the angle. The burring must be done on the *inside* of the angles. Show how the following principle of motion economy could be applied to the operation of burring these holes. Include a diagram of the new set-up.

(1) Gravity feed containers should be used to deliver the material as close to the point of use as possible.

(2) Motions of the arms should be in opposite and symmetrical directions, and should be made simultaneously.

(3) Both hands should begin and complete the same therbligs simultaneously.

(4) Hands should be relieved of all work that can be transferred advantageously to other parts of the body.

(5) "Drop deliveries" should be used whenever possible. Tools and finished work should be dropped or thrown when the nature of the work permits.

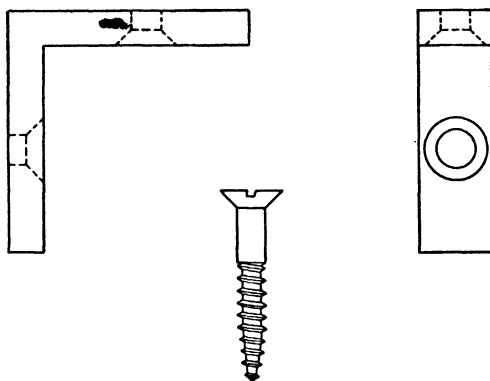


FIG. 27.—Layout of the burring of angles.

8. Make a time and motion study of a personal job which you have to do, or an industrial job which you have done, or have to do, or supervise.

Simplification, Standardization, and System

9. Report on the activities of the Division of Simplified Practice of the Bureau of Standards of the United States Department of Commerce, Washington, D. C.

10. Report on some simplified practice recommendation or recommendations of the Division of Simplified Practice and the method of preparation.

11. Report on the specific standardizations of one or more of the following: dimensions and proportions, tools, parts, quality, rating of equipment, methods of test, provisions for safety, rules of operation, management standards, nomenclature, and most favorable varieties.

12. Apply simplification to some personal performance, function, or a product or products with which you are personally acquainted.

13. Report of selected references 14 and 15 at the end of this chapter.

SELECTED REFERENCES

POLICIES

- (1) C. L. JAMISON. "The Policies of Corporations." *The Management Review*. New York: American Management Assoc. Vol. XXI. No. 7. July, 1932. Pp. 195-202.

- (2) J. O. MCKINSEY. *Adjusting Policies to Meet Changing Conditions*. New York: American Management Assoc. G.M. 116. 1932. 16 Pp.

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- (3) H. S. DENNISON. *Organization Engineering*. New York: McGraw-Hill Book Co. 1931.
(4) J. R. JONES. *Theories and Types of Organization*. New York: American Management Association. Production Executive Series: No. 83. 1929.

JOB DESCRIPTIONS

- (5) E. B. ROBERTS. "Position Analysis and Classification," *The Management Review*. New York: American Management Assoc. Vol. XXIV. No. 7. July, 1935. Pp. 195-210.

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- (6) R. M. BARNES. *Motion Study*. Iowa City: College of Engineering, University of Iowa. 1933.
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- (12) J. GAILLARD. *Industrial Standardization*. New York: H. W. Wilson Co. 1934. 123 Pp.
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CHAPTER IV

MONEY

Today the management of money is one of the principal factors in the success of management as a whole because money must be available with which to employ men, to purchase materials, to manufacture, to market the product and to make a profit. The management of money involves ownership, financing, general and cost accounting, payment of wages, profits, and the other financial affairs of the company. First, money is made available through ownership—somebody must own the business. This ownership is defined by the financial structure. As materials are used, as men work, and as the product is marketed, an accounting must be made in order to show profit—the prime mover of economic activities and the mark of success of modern management.

OWNERSHIP¹

In general, money matters involve getting money or getting rid of it—borrowing or lending it. One person has the money and wants to put it to use, while another has not the money and wants some to use; the money problem is to get the two together. One of the important uses of money to the man who has it is to buy something and become the owner. Similarly, in industry and business a person or group of persons who have money may become owners by putting money into the business. The common forms of ownership are: the individual proprietorship, the partnership, the corporation, and other forms of ownership such as the joint stock company, the business trust, the holding company, and cooperative and governmental ownership.

The Individual Proprietorship. The individual proprietorship was the original form of private enterprise. The individual owner is the sole manager of all the factors that affect his

¹The author is indebted to Mr. R. B. Stewart, Comptroller of Purdue University, for much of the material in the divisions on ownership and financing, given in lectures to the former's classes.

particular business. He hires whom he pleases, buys what he pleases, and conducts his business in whatever way he wants to. He is responsible to himself personally for profits and losses, and is legally liable for all his acts and possessions. When he dies his affairs as an individual proprietor cease, a situation which may prevent long-time loans to the individual.

The Partnership. In the partnership two or more individuals pool their assets in manufacturing a product or performing some service. They may put in different amounts of money. One may put in money and another services. One may contribute capital, one experience, and another services or prestige, with an agreement as to the division of profits. Each partner is an agent for the business and can make contracts binding each and all of the partners. Any act of any one partner binds the others. Each partner is liable for the debts of the firm even to the extent of his private property. If one partner purchases anything for the firm, all the partners are liable for the obligation contracted. In some partnerships the partners divide the profits and losses equally, and in some states limited partnerships exist under the law whereby the liability of the partners may be limited. Under a general partnership all partners must assume the responsibility for the integrity and services of the other partners. That is why professional firms such as lawyers and doctors are partnerships, because when a person patronizes a firm of lawyers or doctors he is buying the reputation of the firm or the individuals of the firm, who must perform their services with such high integrity that they will hold the confidence of their clients. Each partner trusts the others. If such partners do not trust each other, they could hardly expect clients to trust them.

The Corporation. In many business proprietorships and partnerships, there grew a desire and need to shift responsibility from the shoulders of individual persons to the firm. This led to the organization of the corporation. A corporation is an intangible being existing only in contemplation of law. It loses the element of personal responsibility and is a separate entity, doing only those things which the law permits and which the state, in a charter or articles of incorporation, authorizes it to do. The corporation is virtually a contract with the state. The principals of a corporation are responsible for the acts of its agents, but the agents are not responsible for the acts of the

principals. The corporation, being an artificial person, is not the stockholders because they own it, yet the corporation owns the corporate property. Because its life is not contingent upon the life of the stockholders, the corporation is permanent and exists throughout the life of its charter.

Formerly a corporation was organized only by means of legislative enactment, but in recent decades the states have passed laws providing for the organization of corporations by groups who have complied with the requirements of the statutes. If a person wanted money to launch a business and decided upon the organization of a corporation, he would execute the proper charter or articles of incorporation and file it with the proper officer, as the secretary of state. Where the law of the state gives that officer the authority to grant charters, and when the proper fees are paid and the requirements of the law are met, the charter will be granted and the work of the corporation may proceed. It is usually considered good policy for a corporation to incorporate in the state where it is to carry on its principal business.¹ The corporation laws of some states are more liberal than others. For example, in New Jersey or Delaware the corporation can do many different things provided the home office and the annual meeting are in the state. Under the corporation form a person does not necessarily have to put in his own money. He can provide services and raise the money for the corporate ownership. One person may be a good buyer and another a good seller, and with capital the two may provide the skill necessary for the success of the corporation.

The charter and articles of incorporation of a company usually provide for by-laws which make it possible for the company to change certain internal arrangements as desired, such as the methods of voting and the methods of making contracts. The broad purpose and provisions, however, cannot be changed without a change in the charter or articles of incorporation. The officers of the corporation are usually the chairman of the board, the president, vice-president, treasurer, comptroller, auditor, and secretary, each of whom has his regular prescribed duties. The general financial management of a corporation is handled by the board of directors acting as a board. The details of the management are left to the officers. The officers are elected by

¹ C. W. Gerstenberg. *Financial Organization and Management of Business*. New York: Prentice-Hall. 1932.

the directors, and the directors are selected by the stockholders, so the fundamental powers may be said to rest with the stockholders.

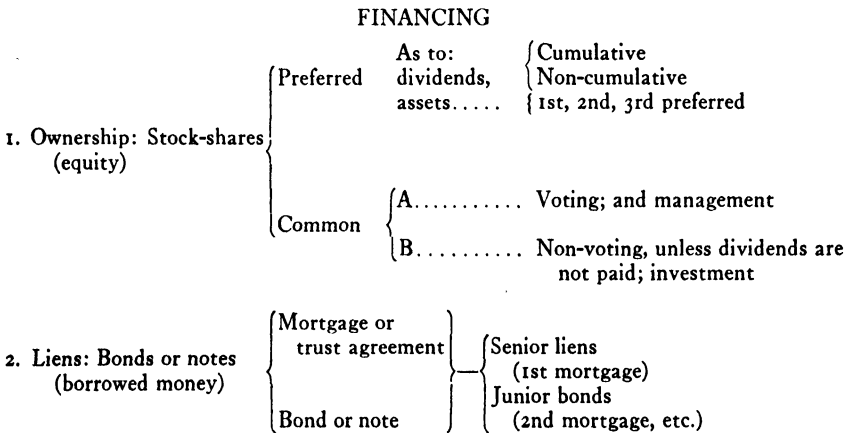
The corporation has only those powers expressed and implied in the charter. The stockholders vote in person or by proxy, but the directors vote only in person. The stocks of corporations are classed as voting and non-voting, the latter having ownership but no vote in the management.

Besides the distinctions mentioned, there can be public corporations and public service corporations,¹ moneyed corporations¹—such as banks and insurance companies—holding companies, and private corporations which are the ordinary business corporations.

Besides the individual proprietorship, the partnership, and the corporation, there are many varieties of combinations of these, and also some types of ownership which do not fall in these categories, such as the joint stock companies, and business trusts or "Massachusetts" trusts.¹

FINANCING

The methods of obtaining money for the purpose of financing a company may be classified generally into (1) ownership and (2) liens. Each of these has its many ramifications, which may be outlined in general as follows:



One means of obtaining money is through ownership—the

¹ For a description of these see C. W. Gerstenberg, *Financial Organization and Management of Business*, New York, Prentice-Hall, 1932.

sale of certificates of stock which represent a share of the aggregate ownership of a corporation. Each type of stock is divided into identical units called shares, which are represented by certificates of stock. The stock is the ownership, and the shares are units of ownership evidenced by the certificates which are issued to the purchasers. Groups of stock are usually classified as preferred and common. The preferred stock usually carries with it a preference over the common as to dividends and assets. As to dividends, the preferred may be cumulative, which means that if dividends are not paid they accumulate from year to year, or non-cumulative, in which case a dividend which is passed by the corporation is lost to the stockholder. If the preferred stock gives preference over the common as to assets, the preferred stockholders have the right of first lien upon the assets of the company. Also different preferences may exist such as first preferred, second preferred, third preferred. There may be stock classes A, B, C, etc. This means that the first preferred has the preference or first right to assets over the second, or the A over the B.

Common stock usually carries with it a voting privilege, and therefore the right to control and manage the affairs of the corporation. However, the common stock may be divided into classes A, B, etc., where class A stock is usually the voting stock, and only those holding the class A stock can control the financial affairs of the company and elect the officers who manage its operations. The common stockholders elect the directors. The directors elect the officers. The class B stock is usually non-voting (except when dividends are not paid). The class B stock is usually an investment stock and shares in any extra profits enjoyed by the corporation. A stated dividend on the class B stock may be paid before the dividends on class A are paid.

Control of the corporation may be obtained by obtaining control of the class A common stock. This facilitates obtaining control of such a corporation with a relatively small amount of capital. For example, a company capitalized at \$100,000 might issue \$50,000 worth of bonds, \$20,000 worth of preferred stock, \$10,000 worth of class B common stock, and \$20,000 worth of class A common stock. If the class A were the only voting stock, the control of the company might be obtained by the purchase of 51 per cent of the class A common stock, which would represent an investment of only \$10,100 in this example. The certificates

of stock may have a par value or they may be no-par. Under the par value system each share is appraised and given a par or face value, which is the capital stock divided by the number of shares. Even so, because of the fluctuation of the finances of the company, the stock may be worth more or less than its par value. A share of stock is equal to one part of the total worth of the company. If a company has 1,000 shares, each share would be equal to $\frac{1}{1000}$ of the worth of the company, regardless of its par value.

Many stocks have no par value, in which case the aggregate ownership is divided into shares, and dividends paid at the rate of so much per share. The no-par stock can often be sold at more nearly its fair value. The purchasers often get a better conception of the value of the stock, yet such stocks may present the disadvantages that their real value may not be known, and that an accounting for their actual value may be difficult to secure. Whether a stock has a par value or no-par value, it should be remembered that, after all, one share is equal to only one part of the worth of the company, and that the real value of any stock depends upon the worth (net assets) of the company, regardless of the amount printed on it.

The financing of a company may also be handled by borrowing money—liens. These liens may be in the form of bonds or notes. A manager may borrow money from a bank, giving his note for the money which is secured by property or other collateral. If the loan is for a long period, bonds are usually issued with one or more mortgages on the property of the borrower as security. A bond is the written acknowledgment of the debt. It is generally made to the bearer, usually with interest coupons attached which are redeemed upon presentation to a bank and then forwarded for collection to the fiscal agent of the company.

Bonds may be classified as follows:¹ (1) senior liens or bonds, which mean first liens, and are usually secured by first or general mortgages; (2) junior bonds, which are usually used to refund and are secured by second mortgages; (3) specific liens; (4) collateral bonds; (5) debenture bonds; (6) receiver's certificates; (7) assumed bonds of another company; (8) income bonds—secured by income; (9) open end bonds—unlimited as

¹ For description of these see A. S. Dewing, *Corporation Finance*, New York, Ronald Press Co., 1931. Also see other publications by that same author.

to reasonable amount; (10) serial bonds—due at different dates; and (11) equipment trust bonds—to buy equipment for operation. Bonds usually are a safer investment than stocks, as the dividends or interest rate is guaranteed and the bond is usually secured by a mortgage right on certain property. In case of default the property usually goes to the bond holders.

The interest on bonds is a fixed expense—the larger the bond issue the larger the fixed expense. High bonded indebtedness should usually be avoided unless profits are practically certain to be greater than the interest on the bonds. However, if the profits are not so great as the interest on the bonds, difficulty will ensue—with possibilities of foreclosure or financial loss. This emphasizes the fact that in any financing or purchasing of stocks or bonds the balance sheet and the profit and loss statement should be closely scrutinized. As general rules, the current assets and current liabilities should be equal, and the fixed assets should be two, three, or four times the fixed liabilities. A wise manager of money will be cautious, consider his investments thoroughly and carefully, and make the offerer of the stocks or bonds prove all his statements.

GENERAL ACCOUNTING¹

When any money is received or expended, a detailed accounting should be made. This is especially important to the modern manager, as it has been estimated that about 40 per cent of a manager's work has to do with accounting and related or allied subjects. Therefore the modern manager will be greatly handicapped unless he has a knowledge of the principles of accounting. Particularly, he must know how to read financial reports and determine progress, or decline, from the accountant's reports, which are the financial language of his business.

From the management viewpoint the purposes of accounting are:

1. To give information upon which the management must base its decisions and actions, and for regular and special reports.
2. To tell those interested in the business—stockholders,

¹The author is indebted to Mr. W. A. Bodden, Chief Accountant, Purdue University, for many of the ideas on general accounting given to the former's students.

owners, and officers—whether the business is making or losing money in a given period.

3. For historical value and importance.

One of the most essential principles of accounting is that the records must be correct and reliable. In order to accomplish this, the manager must know the fundamental basic principles of accounting and how the figures are built up and obtained; he should have the figures checked by at least two experienced employees and have capable men to do the accounting. The marks

Date	Description	Debit (in)		Credit (out)	
1936 October 1	Cash (1a) Merchandise (1b) Merchandise sold for cash	100	00	100	00
2	Merchandise (2a) Cash (2b) Bought merchandise	50	00	50	00
3	Accounts Receivable (3a) Merchandise (3b) Sold merchandise on credit	10	00	10	00
4	Merchandise (4a) Accounts Payable (4b) Bought merchandise on credit	100	00	100	00
5	Rent Expense (5a) Cash (5b) Paid rent for month of October	30	00	30	00

FIG. 28.—Journal.

of a good accounting system are: (1) a double-entry system of bookkeeping, (2) an adequate system of internal checks, (3) a system which is basically simple and mechanically easy to operate without too highly skilled help, (4) a uniform flow of work throughout the accounting period, (5) full information for regular and special reports on the financial status of the company.

When businesses were small in the earlier days, the manager used only a single-entry system of accounting. Cash was received and expended, but this method of bookkeeping did not tell him where he stood financially at the end of the accounting period, such, for example, as the status of his cash, merchandise, accounts receivable, his assets, liabilities, and overhead. This led to the adoption of the double-entry system of accounting, which considers the two sides to every transaction—something given and something received. The double-entry system records both

sides—debit and credit. “Debit” may be interpreted as referring to that which comes *into* the business on account, and “credit” as that which goes *out*. The simplest double-entry system involves the following books and procedure: the journal, the ledger, and the trial balance. The journal is a chronological record of the various (daily) transactions of the business as shown in Fig. 28. As the transaction occurs it is recorded

CASH							
Debit (in)				Crédit (out)			
Date	Description	Folio	Amount	Date	Description	Folio	Amount
Oct. 1	Merch-Sales (1a)	1	\$100 00	Oct. 2	Merch-Purch (2b)	1	\$50 00
				5	Rent Paid (5a)		30 00
	Balance		100 00		Balance		20 00
			20 00				100 00

MERCHANDISE							
2	Merch-Purchased (2a)	1	50 00	1	Merch-Sales (1b)	1	100 00
3	Merch-Purchased (4a) (on credit)	1	100 00	3	Merch-Sales (3b) (on credit)	1	10 00
	Balance		150 00		Balance		40 00
			40 00				150 00

ACCOUNTS RECEIVABLE							
Date	Description	Folio	Amount	Date	Description	Folio	Amount
3	Merch-Sales (3a) (on credit)	1	10.00				
			10.00				0 00

ACCOUNTS PAYABLE							
				3	Merch-Purchased (4a) (on credit)	1	100 00
			0 00				100 00

RENT							
5	Rent paid (5a)	1	30 00				
			30 00				0 00

FIG. 29.—Ledger.

chronologically in the journal, as for example, if a hundred dollars' worth of merchandise is sold for cash, then the \$100.00 cash comes "in" and is debited in the journal and \$100.00 worth

Description	Debit - (Dr.)		Credit - (Cr.)	
Cash	\$20	00		
Merchandise	40	00		
Accounts Receivable	10	00		
Accounts Payable			\$100	00
Rent	30	00		
Totals	100	00	100	00

FIG. 30.—Trial balance.

of merchandise goes "out" and is credited in the journal, and so on with the other transactions shown in Fig. 28. The ledger shows the condition of each account of the company. The transactions listed in the journal are posted to their proper accounts in the ledger as shown in Fig. 29. For example, the five transactions listed on the journal are posted to the respective accounts on the ledger as follows: In the first transaction, that of selling for cash \$100.00 worth of merchandise, the cash account in the ledger is debited (1-a, Fig. 29) with merchandise sales \$100.00, and the merchandise account is credited with merchandise sales \$100.00¹ (1-b). In the second transaction, that of buying \$50.00 worth of merchandise for cash, the merchandise account in the ledger is debited \$50.00 and the cash account is credited with \$50.00. In the third transaction, the sale of \$10.00 worth of merchandise on credit, the accounts receivable account is debited \$10.00, and the merchandise account is credited \$10.00. In transaction four, that of buying \$100.00 worth of merchandise on credit, the merchandise account is debited with \$100.00, and the accounts payable account is credited with \$100.00. In the fifth transaction, the payment of \$30.00 rent, the rent account in the ledger is debited with rent paid \$30.00 and the cash ac-

¹ For simplicity the fact that the merchandise account is a mixed account is ignored.

count is credited with \$30.00. If at the end of that fifth day the manager wished a trial balance of the transactions, the ledger accounts would be totaled and their differences posted to the trial balance as shown in Fig. 30. The cash account in the ledger shows \$100.00 debit and \$80.00 credit, which would make a \$20.00 difference on the debit side; so the cash posted to the trial balance would be \$20.00 debit. In the merchandise account on the ledger there is a total of \$150.00 debit and \$110.00 credit, making a balance of \$40.00 which would be debited on the trial balance. Then the accounts receivable item of \$10.00 and the rent item of \$30.00 would be posted on the debit side of the trial balance and the accounts payable item of \$100.00 on the credit side. By totaling the debits and credits in the trial balance we now find each column equaling \$100.00, which shows that all debits and credits have been posted to the ledger.

This procedure represents the simplest form of the double-entry system. The more elaborate systems are sometimes broken down into many accounts, with one person doing the bookkeeping on one account. However, the accounting procedure just explained forms the basis of all double-entry systems. The double-entry system which has the other requirements of a good accounting system should result in accurate information available, from which the management can make its decisions by knowing full facts about its money. If the accounts do not produce the desired information or results, it is evident that something is wrong with them, the system, or the accountants.

COST ACCOUNTING

The general accounting system does not usually go into sufficient detail for the manufacturing department to determine the specific cost or costs of products, processes, and manufacturing operations by the material, labor, and overhead expense involved. Cost accounting does furnish this information and applies general accounting principles to the determination and recording of expenditures entering into the cost of manufacturing a product or performing a service. Cost accounting aims are to verify the past expenditures, determine the present costs, and estimate and control future costs and needs. These purposes should include not only the keeping of the actual costs, but also standard costs by which the management may guide and control or manage its money and costs of manufacture.

The principal elements of cost are as follows:

- I. Labor.
 - 1. Direct—labor that directly works on or transforms the product.
- II. Material.
 - 1. Direct—raw material from which the product is made.
- III. Overhead expense or burden—labor, material, and other costs which cannot be charged or allocated to a particular product, job, process, or cost center.
 - 1. Indirect expense.
 - a. Labor. (1) Foreman; assistant foreman; helpers; overtime bonus; etc.
(2) Superintendent; assistant superintendent; engineer; accountant; inspector; watchman; shipping and receiving clerks; legal counsel; salesmen; sales manager; etc.
 - b. Material. (1) Supplies (of cost center or department); tools; defective work; etc.
(2) Heat, light, and power; repairs; maintenance; depreciation; general supplies; office equipment; etc.
 - c. Other overhead or indirect costs.
 - (1) Insurance; taxes; dividends; interest; profit; advertisement; other selling costs; etc.

These elements of cost may be segregated by (1) cost centers or departments, (2) by jobs or orders, or (3) by processes. Cost elements are accounted for principally in the following accounts: storeroom, pay roll, overhead expenses, work in process, finished goods, and sales. The cost accounting procedure is diagrammed in Fig. 31 and involves the steps exemplified as follows. A production order is given by the president or manager of the company, from which requisitions are prepared for the labor and material.¹ When labor is expended and paid for, labor is debited to work in process, and pay roll (or cash) is credited. When material is used, work in process is debited and the storeroom (or cash) is credited. Direct labor and direct material are prime elements of the cost. Further, on the labor side there will be (a) the salary of the foreman and his helper, and overtime wages, and (b) the general or prorated overhead expense of the superintendent, engineering, accounting, receiving and shipping, tool room, watchman, and similar expense. In addition to the direct material there would be also overhead

¹ These first two steps precede the actual cost accounting records unless actual bids have been made previous to the sale.

material expense, such as (a) defective work, manufacturing supplies, and tools, and (b) general or prorated expense, such as power and light, storeroom supplies, repairs and maintenance,

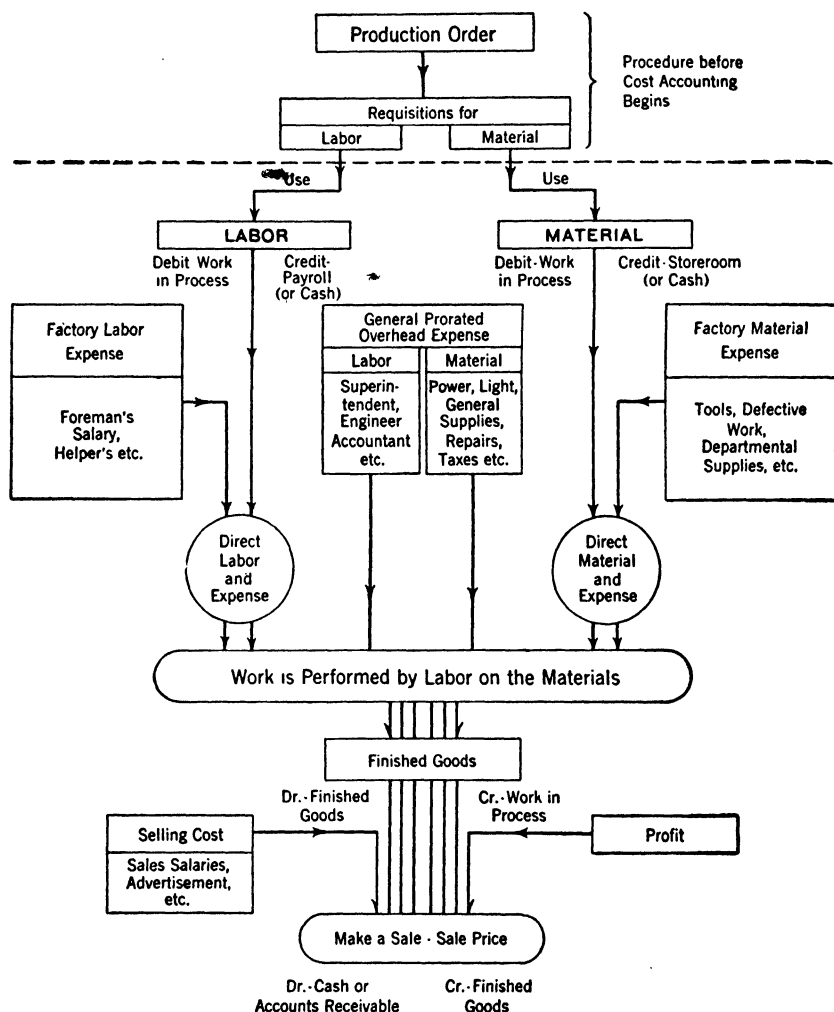


FIG. 31.—Chart of cost accounting procedure. (The author is grateful to D. S. Clark, Purdue University, for assistance in developing this chart.)

insurance, depreciation on buildings and machinery, and the like.

When work is performed by direct and indirect labor on direct materials, and with indirect materials, the result is finished

goods. When goods are finished work in process is credited and finished goods is debited. To the finished goods cost must then be added the selling cost and profits, the sum of which makes up the selling price. When the sale is made, cash (or accounts receivable, if sold on credit) is debited and finished goods is credited. The cost cycle then is ready to repeat itself. This description gives the simplest of cost accounting procedures and does not discuss many of the accounts used and the procedures followed. It gives only the essential framework upon which the cost accounting details are built.¹

In the simplest general terms, cost accounting consists of the determination of and accounting for the material, labor, and the overhead or burden. Figures 32A, B, and C are the principal forms used by the Delco-Remy Corporation to calculate cost.

The cost of material is obtained from the material cost record, Fig. 32A. The direct labor cost is derived from the departmental operation record, Fig. 32B, which is made up from the study records.

The costs of material and direct labor are transferred to the cost record, Fig. 32C, where the overhead expense or burden is calculated (by a certain percentage of the labor) and added, the total of which gives the cost of the part.

Overhead Expense or Burden. In general, the direct labor and material costs are those which can be allocated to the job, the process, or cost center of the department, and usually do not present as much difficulty to determine and allocate as the overhead expense. Overhead expense or burden is usually calculated and distributed by the following methods: the direct-labor-hour method, the labor-cost method, the machine-hour method, the materials method, and the output method.

By the direct-labor-hour method of distributing overhead expenses or burden, the apportionment of this expense is made in the ratio of the direct labor hours worked in the department or cost center to the total direct labor hours worked in the factory. If Department A worked 500 direct labor hours, Department B worked 300, and the other departments 200, the share of the overhead expense allocated Department A would be 50 per cent of the total. If the total overhead expense were \$2,000 for the

¹ For full description of cost accounting see the selected references on the subject at the end of this chapter.

machinery, the direct-labor-hour and labor-cost methods may not equitably distribute the general overhead expenses, and the company may use the machine-hour method. Under this method the general overhead expense is apportioned according to the ratio of the machine hours for a department to the total number of machine hours for the factory.

The material method involves the apportioning of the burden according to the ratio of the quantity of material used by the department to the total material used in the factory.

Companies where the same product is produced by a number of departments may prorate the burden on the basis of the number of units of the product or the cost of the product produced by each department. Besides these methods, a factory or plant may be divided into cost centers to which various direct, indirect, and general expenses are allocated.

In some companies the overhead expense is budgeted and accounted for by different items of overhead in the various departments or functions of the company. A budget is set for each overhead item in each department and the actual expenditures for each item are periodically compared to the budget for those items. Adjustments are made by the management according to the fluctuations from the budget. Figure 33a shows a comparison of the actual expenditures to those of the budget for the various items of overhead in the Duncan Electric Company. Figure 33b gives the operating statistics, profit and loss statement, and analysis. Mr. Holmes, President of the Company, explained these two tables as follows:¹

You will notice that Factory Overhead ran ahead of the budget and that this was entirely due to MF Labor Variations. This variation represents an increase in the MF Labor Inventory in Process.

X-25 represents labor and parts that must be re-worked. A similar item is also included under Production Control and Purchasing in "Other Variables," and the same is true of Engineering.

Overhead Used for Capital Accounts arises from the fact that for thirty years or so we have added 100% overhead to labor in valuing tools made in our own shop. It, of course, is a profit item at the time the tool is made and is charged off through depreciation.

Material Price Variation arises from the fact that our material, no matter where it may be, is priced at standard costs. When material comes in, the invoice is figured at actual and at standard and the difference goes into the Material Price Variation account. One of these days this account, instead of

¹Letter to the author, dated Oct. 29, 1936.

FIG. 33a.—DUNCAN ELECTRIC COMPANY
(La Fayette, Indiana)

OVERHEAD REPORT FOR 1st. Period ENDING March 25, 1936

	*Budget	Actual	From 2/27 To Date *Budget Actual
ADMINISTRATION (FH)			
Variables	\$ 554.	405.	
Fixed, at Actual	\$ 1,602.	1,242.	
Total Adm. OH'd.	\$ 2,156.	1,647.	
SALES (JEB)			
Advertising	\$ 862.	423.	
Commissions	\$ 3,199.	2,751.	
Travelling	\$ 995.	492.	
Salescentives	\$ 616.	500.	
Rebldg. Recalls & Losses on allowances	\$ 32.	35.	
Other Variables, at Actual	\$ 325.	192.	
Total Variables	\$ 6,029.	4,395.	
Fixed, at Budget-Actual	\$ 2,018.	1,570.	
Total Sales OH'd.	\$ 8,047.	5,965.	
ENGINEERING (SG)			
Variables	\$ 690.	402.	
Fixed, at Actual	\$ 1,670.	1,583.	
Total Engineering OH'd.	\$ 2,360.	1,985.	
DEMAND ENGINEERING (BLE)			
Variables	\$ 296.	326.	
PRO. CONTROL + PURCHASING (FD)			
Material Price Variation	\$ 296.	-557.	
Labor	\$ 510.	571.	
Rebuilding Stock	\$ 12.	4.	
Other Variables	\$ 702.	1,204.	
Total Variables	\$ 1,520.	1,222.	
Fixed, at Actual	\$ 665.	526.	
Total Pro. Con. & Pur. OH'd.	\$ 2,185.	1,748.	
FACTORY (BLE & FS)			
Manufacturing Aids:			
Elect., Gas & Water	\$ 455.	512.	
Tool Repairs	\$ 260.	338.	
Other Repairs	\$ 497.	451.	
Other Aids	\$ 902.	875.	
Material Variations	\$ 35.	23.	
Labor Variations:			
Spoil. & X25 Work & Equip.	\$ 320.	393.	
Shop Order Variations	\$ 29.	0.	
Day Work Variations	\$ 12.	9.	
Change in Std. Cost—Labor	\$ 12.	0.	
MF Labor Variations	\$ 260.	2,152.	
5% Wage Increase	\$ 533.	644.	
No Charge Customer Repairs	\$ 32.	7.	
OH'd. Used for Capital Accounts	\$ -502.	-507.	
Total Variables	\$ 2,845.	4,897.	
Fixed, at Actual	\$ 5,284.	5,157.	
Total Factory OH'd.	\$ 8,129.	10,054.	
TOTAL MANUFACTURING OVERHEAD	\$12,970.	14,113.	

Prepared by Frederick Holmes, President

FIG. 33b.—DUNCAN ELECTRIC COMPANY

(La Fayette, Indiana)

MANAGEMENT REPORT FOR 1st. Period ENDING March 25, 1936

OPERATING STATISTICS

New Tools—Replacement	—Yr. to date \$	239.
New Tools—Methods	— " " " \$	0.
New Tools—Design	— " " " \$	3,668.
Ratio <u>Matl. Req. Period</u>	—	.93 to 1.
<u>Std. Matl. Stocked</u>		
Ratio <u>Actual Labor Period</u>	—	1.13 to 1.
<u>Std. Lbr. Stocked</u>		
Ratio <u>Raw Matl. Content Billings Per.</u>	—	.34 to 1.
<u>Raw Stock & Matl. in Process</u>		

PROFIT AND LOSS

	*Budget	Actual	From 2/27 To Date *Budget Actual
Net Billings	*\$ 44,100.	67,942.	
Std. Labor, Matl. & OH'd. (incl. 3%)	\$—48,000.	—47,480.	
Gross Profit at Std.	\$ 19,942.	20,462.	
OH'd. Over-Under Absorbed	\$— 1,187.	— 1,725.	
Sales Expense	\$— 8,047.	— 5,965.	
Administration	\$— 2,156.	— 1,647.	
Net Operating Profit	\$ 8,552.	11,125.	
OH'd. Invent. Inc.-Dec.	\$	— 1,238.	
Corrected Operating Profit	\$	9,887.	
Salary Adj., & Other Deductions	\$	— 878.	
Net after all Adjustments	\$	9,009.	

PROFIT AND LOSS ANALYSIS

	Period to date
Budgeted Net Profit	\$ 5,328.
\$ Volume	\$ 3,224.
Variety and Price (Labor & Matl. only)	\$— 113.
Administration	\$ 509.
Selling	\$ 2,082.
Engineering	\$ 375.
Demand Engineering	\$— 30.
Prod. Control & Purchasing	\$ 437.
Factory	\$— 1,925.
OH'd. Invent. Inc.-Dec.	\$ 1,238.
Net Operating Profit	\$ 11,125.

* This represents "Budget at Actual" except for Net Billings, which represent Budgeted Net Billings.

Prepared by Frederick Holmes, President

showing a profit, is going to show a very considerable loss due to increasing price of raw materials.

In our Profit and Loss Statement, you will find the unusual item of Overhead Inventory-Inc.-Dec. If our total Overhead Inventory shows an increase for the period, we treat this increase as a deduction from profit, or rather

we keep this increase from appearing as a profit item, which it would ordinarily do. We see no reason why we are entitled to consider an increase in Overhead Inventory as a profit. When the Overhead Inventory shows a decrease, we do consider this a profit, and take care of it in this same account. In other words, when we let our Overhead Inventory increase, we feel that that means a somewhat inefficient operation, and there is no reason for letting it appear as a profit, and, on the contrary, when we reduce our Overhead Inventory, we think that is a good thing and believe it should show as a profit, or rather that it should not detract from profit.

In addition to this safety factor in handling Overhead from period to period, we set up at the beginning of the year, and make changes from time to time as may seem necessary, a reserve for a lower rate of inventory at the end of the year than at the beginning of the year. This is because in pricing our inventory we use actual rates of overhead at the end of the year. Many concerns using standard costs use a standard rate of overhead, no matter what the actual may be. We are continuing with our former procedure on this because we consider it to be more equitable under existing tax laws. Furthermore, it is the old and well-established accounting practice. From a purely technical standpoint, it is our feeling that Overhead Inventory should not appear in a balance sheet at all. Its inclusion results in a fictitious profit or in a fictitious loss. The only way to avoid such fictitious profits and losses is to keep the Overhead Inventory at a fixed amount or to eliminate it entirely. The mere maintenance of a standard rate of overhead, no matter what the year's operations may show, does not prevent such fictitious losses and profits from appearing in the Profit and Loss Statement.

We think that the most interesting part of this report is the Profit and Loss Analysis. . . . Variety and Price, Labor, Material, and Overhead represent the difference between budgeted gross profit at standard and actual gross profit at standard, or a profit item of \$520.00. The Variety and Price (Labor & Mat'l. only) figure of minus \$113.00 is arrived at as follows:

Profit	\$520.00
Less difference between the budget overhead cost of sales and actual overhead cost of sales.....	\$633.00
Loss	<u>\$113.00</u>

Depreciation. One especially important item of overhead expense or burden is depreciation—the financial loss of life or useful value due to wear and tear, deterioration, use obsolescence, inadequacy, the cessation of demand for use, and the passage of time. Although care and attention to property, such as maintenance, repairs, and alterations, can be given to arrest depreciation, its causes cannot be prevented entirely. Depreciation exists, and its cost must be calculated and apportioned. In general, there are a number of methods of calculating and apportioning depreciation. One of the simplest is to record the age in years as a piece of equipment or property goes out of service.

When the data of a large number of units have been collected, they can serve as a basis for figuring depreciation. If a piece of equipment has been in service for twenty years, the depreciation rate would be one-twentieth, or 5 per cent. A better method is to find the life of a number of the same units and determine the average life, rather than the life of one unit, of course; calculating the use to be made of the property.

In recent years the United States Bureau of Internal Revenue and industrial and accounting authorities have developed tables of depreciation rates which give the various rates of charging off depreciation of various types of equipment and property. A number of depreciation rates follow:¹

TABLE VI
EXAMPLES OF DEPRECIATION RATE

Item	Rates in Per Cent	Authority
Buildings.....	3-5	Am. Boilers Mfrs. Assn.
Cranes, electric traveling.....	5	Bureau of Internal Revenue
Lighting systems: Conduits, fittings and wiring.....	4	Bureau of Internal Revenue
Elevators.....	4-10	Ill. Mfrs. Costs Assn.
Compressors, stationary all types...	5	Bureau of Internal Revenue
Engines: Gas and gasoline.....	6	Bureau of Internal Revenue
Automobiles.....	15-25	American Appraisal Co.
Lathes: Engine.....	6 $\frac{3}{4}$	Bureau of Internal Revenue
Office furniture and fixtures.....	15	Nat. Mach. Tool Bldrs. Assn.
Screw machines.....	4-6	American Appraisal Co.
		Bureau of Internal Revenue
Tools, small.....	20	Ill. Mfrs. Costs Assn.

The rate of depreciation can be figured from several bases such as the entire or adjusted costs, cost of maintenance, the replacement or reproduction cost, or the present value which is usually determined by appraisal. After the rate of depreciation and base have been calculated the depreciation must be apportioned. Some of the methods of apportioning depreciation² are: the annuity method, the compound interest, straight-life, sinking fund, reduced balance, and other methods.

Standard Costs. In recent years cost accounting has developed

¹ A fuller list of rates and sources can be found in L. P. Alford's *Costs and Production Handbook*, New York, Ronald Press Co., 1934, pp. 1241, etc.

² For a description of these methods of apportioning depreciation see L. P. Alford, *Cost and Production Handbook*, pp. 1236-69.

to standard costs which are those costs that *should* be maintained. Standard costs guide the manager in the control of costs, as well as serving as the goal of operation. For standard costs the material required is accurately calculated by engineering analysis. The labor requirements are determined by time and motion study, and in some cases by past performances. The general overhead is calculated from past experience and from ratios to direct cost. These standard costs give the management information by which costs can be predicted and controlled, instead of simply telling what actual costs are or have been, as old accounting methods did. Standard cost¹ is the new development in cost accounting of what the costs *should* be.

The cost accounting system fits into the general accounting of the company through such accounts as work in process, general stores, and finished goods.

WAGE INCENTIVES

Financial incentives have long been the principal means of stimulating achievement in industry. Wages constitute the total income for a large part of the people in this country, and comprise a large portion of the purchasing power. From management's viewpoint wages are a substantial part of the manufacturing costs, and from the consumer's point of view they are much of the price paid.

The worker is interested in securing as high wages as he possibly can, and generally wants to see high wages, so that his purchasing power will be as great as possible. Industrial management is interested in being able to sell its products at the lowest possible price; therefore it is interested in the lowest unit cost of production. Some people contend that the high wages that the worker wants and the low cost which the management desires are antagonistic ideas, but in recent years many have come to see that high wages and low unit costs are possible. Therefore, one of management's large problems is to increase the workers' wages and at the same time decrease unit costs of production. One method of accomplishing this in recent years has been by means of the incentive wage systems.

The three basic methods of wage payment are broadly: (1)

¹For a fuller explanation of Standard Costs see Charles Reitell, "Standard Costs," *Factory Management and Maintenance*, May, 1935, p. 3-33; and references at the end of this chapter.

time wage, (2) piece rate, and (3) premium and bonus. In 1935 the National Industrial Conference Board¹ investigated 631 manufacturing establishments which employed more than 700,000 wage earners. They found 56.3 per cent of the wage earners on time rates, 22.1 per cent on piece rates, and 21.6 per cent under premium and bonus systems.

In 1924 this same board had found time rates being used in 56.1 per cent of the companies, piece rates in 36.6 per cent, and premium and bonus systems in 7.3 per cent. The percentages of time rates remained about the same. Those covered by piece rates decreased about one-third, while the percentage having premium and bonus plans increased almost three times from 1924 to 1935. This emphasizes that the various premium and bonus systems are increasing rapidly in popularity in this country, and that all managers should be familiar with them, not only from the general point of view, but with reference to specific industries. The National Industrial Conference Board found that 83.3 per cent of the employees in the automotive industries were paid by straight time rates in 1935, 80.4 per cent in the clothing industries used individual piece rates, and 54 per cent of the printing and publishing companies used premium or bonus plans.² In the smallest and largest companies straight time rates were used more than in the medium-sized companies. The extent of use of each method of wage payment varies in the individual company, as well as in each industry.

In establishing a new wage payment plan, or changing an old one, it is necessary to consider all the factors that enter into the job on which the wages are being paid, and the work of the company and the industry. This involves the application of the scientific method to the problem of the proper wages for a particular job. The ideal is to accomplish the highest possible wages for the worker and the lowest possible cost of production, with the exertion of such effort that the worker will develop personally on the job. In changing a wage payment plan or a rate these three principles should be considered: (1) the unit cost of production should be decreased, (2) the wages of the workers involved should be increased, and (3) the new work and working conditions should be designed so as to increase the

¹ National Industrial Conference Board. *Financial Incentives*. New York. No. 217. 1935. P. 17.

² National Industrial Conference Board. *Op. cit.* P. 19.

efficiency and promote the personal development of the employee.

Many managements have emphasized principally the first principle—to decrease the cost of production. They have paid little attention to increasing wages and providing for the development of the employee. The omission of these last two considerations has been attacked in the past not only by workers, but also by others interested in their welfare.

Uhrbrock¹ states the following in this respect:

Workers object to wage-incentive because they hold beliefs such as the following: (1) standards are unfair, (2) wage-incentive engineers and checkers could not make bonus if they were assigned to the work under standards which they set and administer, (3) not enough observations are taken, (4) the bonus is not high enough for increased effort demanded, (5) plans are too complicated. . . . It probably is true that a technique that has a vital effect upon a man's earnings cannot survive in the long run unless it can be understood and appreciated by the workers affected.

However, it is believed that application of the principles of decreased cost, increased wages, and personal development of the worker will satisfy these objectives.

Barnes² has stated the requirements for a good incentive wage plan to meet these and other objections as follows: (1) guaranteed minimum wage, (2) proper incentive, (3) standards set by time study, (4) standards guaranteed against change, (5) a system easy to understand and simple for the employees to figure earnings under it, (6) a system that will facilitate time keeping and pay-roll computation.

Wages for different kinds of work are not the same, and it is necessary first to consider the base rate or wage for each job or type of work. The base rate is the basic wage agreed upon by employer and employee for a definite job or kind of work at a certain time and in a certain locality. All other rates and wages may be graded from the base rate.

The base rate usually must first consider the demand and supply of the labor. The prevailing wage in a locality is naturally affected by the scarcity or plentifulness of labor and may principally determine the base rate.

In many companies all the factors of each job are studied and

¹R. S. Uhrbrock. *A Psychologist Looks at Wage Incentive Methods*. New York: American Management Assoc. 1935. P. 10.

²R. M. Barnes. *Industrial Engineering and Management*. New York: McGraw-Hill Book Co. 1931. P. 185.

considered very carefully and thoroughly—not only the scarcity of labor but also the working conditions, hazards, physical efforts, and many other factors. The Goodyear Tire and Rubber Company analyzes wage information from the standpoint of the following base rate elements:

Heat of the air	Pace
Heat of radiation	Education
Heat of contact	Initiative
Effect on clothes	Originality
Tools	Planning work
Danger	Accuracy
Dirt	Honesty
Dust	Adaptability
Wet	Sales Ability
Fumes	Memory
Noise	Observation
Monotony	Judgment
Application	Analysis
Eyestrain	Executive ability
Development time	Responsibility
Strength	

Besides these various basic wage factors, the employer must consider the nature of the wage with reference to the worker, from the lowest subsistence wage through the living wage, efficiency wage, and comfort wage to the cultural wage. The subsistence wage is that upon which the worker and his family can subsist. The cultural wage not only is sufficient for a comfortable living for him and his family, but also provides for the education of his children and for his and their cultural development.

Many methods have been devised to give the worker a higher-than-average compensation for better-than-average output, or high wages for low unit costs of production. Figure 34 presents the formulas and charts for determining the workers' earnings, and gives the advantages and disadvantages of the *time rate*, the *piece rate*, the *Halsey premium*, the *Taylor differential piece rate*, the *Gantt task and bonus*, and the *Emerson efficiency plans*.

The method or wage payment plan used by most of the companies is the *time rate*. The earnings under this plan amount to the rate per period times the number of periods worked. For example, if the rate is \$0.50 per hour and the hours worked are 10, then the earnings are $\$0.50 \times 10 = \$5.00$. Other periods used are the day, week, month, and the year, and earnings are so many dollars per day, per week, per month, or per year. Pay

Formulas	Graphs of Earnings	Advantages	Disadvantages
A $E = TR$ E = Earnings T = Time worked R = Rate per hour	Time Rate Wage Plan $E = TR$	Straight Time Rate Uncertainties eliminated, definite amount guaranteed Easy to calculate Older and experienced worker rewarded Promotes quality production	Worker can easily restrict output Incentive for highest production lacking
B $E = \frac{Nr}{N}$ E = Earnings N = Number of pieces r = Rate per piece	Piece Rate Wage System $E = Nr$	Straight Piece Rate Incentive to maximum production Easily calculated Pay proportionate to output	Principally quantity awarded Lacks guaranteed minimum wage Does not provide for work shortage Usually hard on beginners Lacks fixed wage per period Can work employee to over-exertion
C $E = TR + \frac{S}{N} (S - D) R$ E = Earnings S = Standard time for job N = Time taken for job R = Rate per hour Rowan's Plan: $E = TR + \frac{S - T}{S} (RT)$ E = Earnings T = Time taken for job R = Rate per hour If worker makes standard, his earnings, E , Nr , where N = number of pieces, r = high rate per piece. If worker makes less than standard, his earnings = Nr_1 , where r_1 = low rate per piece	Halsey Premium Plan Rowan Plan TR	Halsey Premium Plan Guaranteed day rate Fair and easy to introduce Incentive for high production Based on time as standard	Somewhat difficult to compute Sharing gain may cause unrest Pay not in direct proportion to output
D If worker makes standard, his earnings, E , Nr , where N = number of pieces, r = high rate per piece. If worker makes less than standard, his earnings = Nr_1 , where r_1 = low rate per piece $E = Nr$ $E = Nr_1$	Taylor Differential Piece Rate Plan Nr TR Nr_1 Step Task done or not done	Taylor Differential Piece Rate Task set by scientific study Worker's pay in proportion to output Easy to compute High incentive for better worker	No minimum day rate guaranteed Hard on beginners Based on money Changes are difficult to make Divides workers into high and low producers
E $E = \frac{Nr}{N}$ E = Earnings N = Number of pieces r = Rate per piece r_1 = High rate per piece	Gantt Task and Bonus Plan Nr TR Guaranteed day rate Task	Gantt Task and Bonus Plan Minimum day rate guaranteed High incentive for high production Standards based on time No difficulty on beginners	Dissatisfaction caused if high rate is not reached Divides workers into low and high producers
F $E = TR + \% \text{ Bonus} \times TR$ E = Earnings T = Time taken for job R = Rate per hour $\%$ Efficiency = $100 \times \frac{\text{Standard time}}{\text{Time taken}}$ $\%$ Bonus = $\text{Bonus} \times \text{Efficiency}$ $\%$ efficiency as shown on the bonus chart	Emerson Efficiency Plan TR $\%$ Efficiency $\%$ Bonus $\%$ Efficiency = $100 \times \frac{\text{Standard time}}{\text{Time taken}}$ $\%$ Bonus = $\text{Bonus} \times \text{Efficiency}$ $\%$ efficiency as shown on the bonus chart	Emerson Efficiency Plan Minimum day rate guaranteed Easy on beginners Standards set scientifically Incentive for highest production Based on time	Hard to compute Hard for worker to understand

FIG. 34.—Wage payment plans. (Devised from: J. R. Bangs, *Business and Industrial Management*. Ithaca, New York: College of Engineering, Cornell University. Mimeographed, 1934. Pp. 226-41; and C. W. Lytle, *Wage Incentive Methods*. New York: McGraw-Hill Book Co. 1931.)

by the week, month, and year is usually referred to as salary instead of wages. However, both salary and time rate wages are based upon time, the worker being paid for the time he puts in. A chart of the time rate method of payment is given in Fig. 34A.

Some companies maintain a multiple time rate plan which provides a step-up in the time wage for an increase in the worker's output. Increases in earnings are automatic as performance improves. The multiple time rate plan depends upon performance classifications and standards.

In an attempt to include the various factors which they considered essential, the Franklin Company used the following general equation for the basic wage rate, where the premium method of payment is used:¹

$$r = \left[\left(\frac{KB(1 + i + m + ny) + R(1 + 2e)}{V(1 + 1.3E - 0.3e)(1 + 0.35P_a) + S} \right) (P_t + P_d(1 + 0.5e)) \right] C$$

and for the determination of labor and indirect cost (not including materials):

$$X = (r(1 + e) + R)t$$

The definitions of terms follow. They are common to both equations:

r = base hourly rate man is to receive.

K = a constant, when V is 100 per cent, to bring worker under standard conditions to standard rate.

B = fundamental base rate.

i = percentage of increase in living since _____ (date since last cost of living was figured), taken on the fifteenth of January, April, July and October of each year.

m = percentage allowed for each extra process known or learned.

n = percentage allowed for years of connected service.

y = years of such service.

R = fixed charges rate per hour which man has chance to modify.

e = percentage of premium earned on time allowance.

V = 100, which is the standard accomplishment per cent.

E = standard premium task time set.

P_a = percentage of time absent or late.

S = value of spoiled work per producing hours worked.

¹ Major George D. Babcock, *The Taylor System in Franklin Management*. New York: Engineering Magazine Co. 1917. Pp. 84, et seq.

P_t = percentage of time under task.

P_d = percentage of time spent on non-task or straight time work.

C = cooperation and conduct.

X = labor and fixed charge cost.

t = time taken to do work.

In recent years there has been a tendency to maintain the straight time rate but to set a standard of performance which is required of the worker. Very careful time and motion studies are made of each job and a standard amount of production is set for the job. The worker is instructed as to the required output and informed that his pay will be so much per hour, per day, or per week as long as he consistently does the work at the required performance standard. Should he continually fall below the performance standard he would have to be transferred to another job, dismissed, or allowances made.

This method is especially favored in industries which employ mass production methods where conveyor belts are used to regulate uniform quantities of production.

Under the *piece rate system* the worker is paid in direct proportion to the amount which he produces. He is paid so much per piece produced, the more pieces being produced the higher being his earnings. For example, if the rate per piece is \$0.05 and he produces 100 pieces per day, the worker's earnings will be $\$0.05 \times 100 = \$5.00$. The formula and chart for the piece rate system are given in Fig. 34B.

Many of the earlier piece rate systems did not provide for a continuous flow of work to the worker, and, also, the new employee sometimes encountered difficulty in earning as much as the day rate formerly paid. This led to a new development in the piece rate whereby the worker was guaranteed a minimum day rate formerly paid. This led to a new development in the piece rate whereby the worker was guaranteed a minimum day rate and was paid that rate until a certain number of pieces were produced, which is shown by a dotted line on the chart of Fig. 34B.

Halsey, believing that the worker could be stimulated to even greater achievement than by the straight piece rate, gave to him added incentive above the regular straight piece rate for better than standard production. This became known as the *Halsey premium plan*, whereby as the worker increases his output or

produces more pieces than the standard task he receives wages for a certain percentage of the saving in time. The worker usually receives 50 per cent of the time saved. The formula and chart of this plan are shown in Fig. 34C. If the standard time for the job is 8 hours, the time actually taken for the job 6 hours, and the rate is 50 cents per hour, the earnings would be $6 \times 0.50 + 50 \text{ per cent } (8 - 6) \times 0.50 = \$3.00 + 0.50 = \$3.50$ for the 6 hours, which would be an average wage of 58 cents per hour. If the man continued to work at that rate for the full 8-hour day he would receive 8 times $0.58 = \$4.64$ for that day.

Taylor wished to secure the best workers possible, so he highly rewarded excellent workers and penalized the poor ones. In order to accomplish this he did not only look with disfavor upon the guaranteed day rate, but he devised the *Taylor differential piece rate* which involved a low piece rate below standard production and a high piece rate for production above standard. As soon as a worker produced the standard set, his rate per piece immediately jumped to the higher figure. For production below task his earnings would be equal to the low piece rate times the number of pieces. For example, if the low piece rate were 3 cents per piece and the high piece rate 4 cents, the earnings for the men producing under standard would be 3 cents times the number of pieces, and for those producing above—4 cents times the number of pieces.

Gantt believed that Taylor's differential piece rate was too hard on beginners, so he devised the *Gantt task and bonus*. Under this plan a day rate is guaranteed up to standard task, and above standard the worker is paid by a high piece rate similar to *Taylor's differential piece rate plan*.

Emerson devised a plan of guaranteeing a day rate, but he believed that the worker should receive a graduated bonus as his efficiency increased, so that the most efficient man would receive the highest bonus. The bonus usually starts at $66 \frac{2}{3}$ per cent efficiency and is figured on the basis of the standard time divided by the time taken. A table of bonuses is developed showing the bonus per dollar of wages for each efficiency above $66 \frac{2}{3}$ per cent. For example, an efficiency of 120 per cent may call for a bonus of \$0.40 per dollar of wages. $\text{Efficiency} = 100 \times \frac{1}{8} = 120 \text{ per cent}$. If the time taken for a job were 8 hours, the standard time 10 hours, and the rate \$0.50 per hour, the earnings in this case would be: $8 \times 0.50 + (8 \times 0.50) 0.40 =$

$\$4.00 + 1.60 = \$5.60$ or $\$0.70$ per hour. For the 10-hour day at that rate the worker's earnings would be $10 \times 0.70 = \$7.00$.

For the formulae and charts of the Taylor, Gantt, and Emerson plans see Figs. 34-D, E, and F.

In the last 20 years Mr. Charles E. Bedaux and his associates have developed the *Bedaux wage payment* methods of "measurement and control of human power" which have been applied in more than 700 companies in this country and Europe. Bedaux engineers contend that their principles apply to any form of physical activities. The basic unit, the Bedaux or "B" is defined, and the Bedaux methods are described as follows:

A basic unit (the Bedaux or "B") is used as a common denomination, and represents the standard expectation in productive energy for one man minute of time. This unit of energy is not to be confused with a time unit, since one man minute of work may or may not mean one Bedaux unit of energy. The variation under extreme conditions may be as great as two or more Bedaux units for one man minute and as little as nothing. This can be illustrated by picturing different machines being operated by several workers who all get the full output of their machine at the rate of one piece per minute, but with an actual expenditure of energy varying from zero, in the extreme case of a fully automatic machine, to as high as possibly two times the amount accepted as the Bedaux standard in the case of a machine demanding an extraordinary large amount of physical work to be kept running at full capacity. In such a case the elapsed time per cycle is always one minute, but the human energy expenditure varies from zero to two Bedaux units per piece, and the Bedaux measurement gives an exact knowledge of that variation.

The above example illustrates the value of such energy measurement as against pure time control. It is obvious that with an energy standard representing only a normal value, men and conditions should be such that at least this normal value is given as productive work. If the actual productive output is less, there is waste with resultant high labor costs and, usually, low wages. If too high, there is overstrain and undue fatigue. Either condition has no place or justification in American industry.

Productive energy is not to be confused with fatigue. There is no definite relation between the two. Men are found to work in such an ineffective way as to become fatigued considerably more than others who are producing just as much under identical conditions. Again, men will fatigue at an abnormal rate just because they are not fitted for the work involved. In any case, however, of a given production, under given conditions, there is a definite number of energy units representing the minimum energy requirement with the facilities available.

Such a standard represents, therefore, a normal or reasonable expectation when equipment and facilities are used to best advantage. Experience has shown that with proper analysis of the work and good direction, the average man will meet the standard without difficulty, and where a logical wage incentive is used to promote greater efforts such as can be built up with this

measurement, the average man will reach from 20 to 40 per cent above standard without undue strain. Individuals have been found to average consistently from 50 to 100 per cent above standard and have shown no ill effects whatever after many years of such performance.

Since the basic unit corresponds to the standard expectation in one man minute, standard is always 60 such units per man hour. An average of less than 60 just means that so much of each man hour is wasted in one form or another. It is clear that a yard stick of this sort immediately discloses just what the conditions are as far as labor utilization is concerned.

Any human labor involves simultaneous expenditure of productive, or effective, and non-productive, or ineffective, energy. The first is translated in production, the second is wasted. An experience of sixteen years in this country involving some 500 institutions in a great many industries and over half a million men and women, leads to a conclusion that a portion of ineffectiveness or waste of 5 per cent or less of the total represents very good labor utilization. In recent years we have found a general average approximating 25 per cent labor waste in one form or another prior to study and application. Individual plants or groups have shown from 25 per cent to 50 per cent or even more.¹

The Bedaux standards are set by time and motion study and are guaranteed against change without a change in the operation. If a worker produces 110 pieces in an 8-hour day and if the standard is 5 B's per piece with 5 per cent for allowances, the Bedaux hour would be:

$$\frac{\text{Number of pieces} \times \text{Standard B's per piece} + 5 \text{ per cent allowances} \times (8 \text{ pieces} \times 60 \text{ min.})}{\text{Number of hours}} \\ = \frac{110 \times 5 + (8 \times 60)0.05}{8} = \frac{574}{8} = 71.75 \text{ B's}$$

If the worker's share were three-fourths of the savings and the base rate of the job 50 cents, the final rate of this worker would be $0.50 + \left(\frac{71.75 - 60}{60} \times \frac{3}{4} \times 0.50 \right) = 0.50 + 0.07 = \$0.57$ per hour. The total earnings for the 8-hour day would be $8 \times \$0.57 = \$4.56$. Besides being a wage payment plan, the Bedaux system is a plan of management control by considering both productive and non-productive labor, by departments and by products. The following² is an example of the calculation of the standard productive and non-productive costs in a foundry under the Bedaux system:

¹ From a lecture given by Mr. Albert Ramond, President of the Chas. E. Bedaux Co. of Chicago, to the engineering seniors of Purdue University on Nov. 13, 1935.

² Given to the author by G. B. Graves, Industrial Engineer, Bedaux Standards Dept., U.S.L. Battery Corp., Feb. 26, 1935.

The foundry standard production cost is figured as follows:

Mold grids (automatic)	48.1 hrs. @ 0.43	\$20.68
" " (hand mold)	67.8 " @ .38	25.76
" small parts	26.1 " @ .38	9.92
Trim grids	17.4 " @ .38	6.61
	159.4	\$62.97

62.97 divided by 159.7 gives \$.394 as base rate.

0.394 divided by $60 \times 100 = \$0.658$ standard cost per 100 productive B's.

Non-productive cost

Ratio

Inspection 4. $\frac{1}{4}$ times 0.25 divided by 60 = \$.00104.

0.00104 times is \$.104, which is the non-production cost per 100 productive B's.

Total Cost

Productive \$0.658

Non-productive 0.104

Total \$0.762

Under the Bedaux system the non-productive workers as well as the productive workers are rewarded and standards are set for both. Analysis sheets are made out by departments and given in uniform quantities of B's. This furnishes to the management specific and comparative information by departments for executive decisions and management control.

Many other wage payment plans¹ have been devised: the Merrick, Diemer, Dyer, Baum, Rowan, Barth, Bigelow, Parkhurst, Haynes "Manit," Knoepfel, Wennerland, Mansfield, Ernst and Ernst, and other plans.

Most companies pay individual incentives. Some pay premiums and bonuses on the basis of the accomplishment of a group of workers who are jointly engaged in performing a process, such as storing material, shipping goods, and firing boilers. Each function of a member of the group is analyzed and studied, and instructions are prepared. Accurate records of the group and usually of the individuals in the group are kept continuously so that the output of the individual as well as that of the group is known. The wage of each member of the group is based upon the accomplishment of the whole group. This places

¹ For description of these plans see C. W. Lytle, *Wage Incentive Methods*, New York: Ronald Press Co. 1931, 465 pp.; and "Incentive Plans," *Cost and Production Handbook*, New York: Ronald Press Co., 1934, pp. 609-675.

the responsibility of production, and, to a certain extent, supervision and discipline, upon the group, more than it does upon the individual worker or supervisor under the individual incentive plan. Besides these various methods of wage payment, companies pay bonuses for the prevention of waste, improvement of quality, length of service, general merit, regularity of attendance, punctuality, prevention of accidents, etc.¹

From the descriptions of the various wage payment plans and special bonuses it can be seen that there are many methods of stimulating achievement in industry and business. Wise managers will study these plans as well as the various jobs which they manage, and develop and use the wage payment plans or special bonuses which will accomplish in the best manner the policies of their companies. Some companies may use several methods of wage payment. The various bonus systems of the Eli Lilly Company² are good examples of the use of a number of wage payment plans in a particular company.

Recent Trends in Wage Plans. In late 1936 and early 1937 new ideas with reference to wage payment plans began to appear in industry. With an increased tax on surplus, campaigns on the part of the unions to organize labor by industries, increased strikes and a prediction of still more, some of the companies began to reconsider wage payment methods to improve employee morale by putting the employee on a partial profit-sharing basis. Some companies desired to keep the workers' wages from fluctuating too greatly. The United States Steel Company and the General Electric Company provided for increases and decreases in pay as the cost-of-living index of the United States Bureau of Labor statistics rises or falls, within certain limits and reservations.

As it is difficult for a company to raise wages without an increase in earnings, the Westinghouse Electric and Manufacturing Company bases increases and deductions in wages and salaries, normal to the community, upon increases and decreases in company earnings. The Nunn-Bush Shoe Company has adapted a plan to put every employee upon an annual salary

¹ For a discussion of these special bonuses see National Industrial Conference Board, *Financial Incentives*, New York City, No. 217, 1935, 41 pp.

² Eli Lilly Company. *General Information for the Guidance of Employees*. Indianapolis. January, 1933, with revisions of 1936. Pp. 16-35.

subject to the upward and downward revision of the company's gross income or total sales. The Hormel Company has been paying weekly wages based upon annual production.

Other companies, desiring to wait until profits are actually made, before basing wages upon them, paid general *bonuses* at the end of accounting periods, as increased earnings permitted. Such bonuses have been granted by the Chrysler Motor Car Company, the General Motors Corporation, the Standard Oil Company of New Jersey, and hundreds of others. It was estimated¹ that about 1,000 companies gave wage increases or bonuses during the last two months of 1936.

A large number of industrial concerns seem to realize the need of increasing the purchasing power of the workers by raising wages when the earnings of the companies permit.²

PROFITS

Industrial management is tested primarily by its earnings. Profits—the portion of the income over the expenditures or of selling price above costs—usually indicates management's efficiency. They are the motivating force of our economic and industrial activity.

Profits depend upon many factors. One company may stress one factor and make its profits principally by that factor, whereas another may stress another factor and secure profits by it. Good management will consider and use as many as possible of the following factors on which profits are based: (1) service; (2) management and administrative efficiency; (3) efficient production methods, and high reward or incentive for skill, knowledge, and excellent effort; (4) strong financial structure; (5) patents; (6) efficient marketing, including superior advertising and efficient sales management; (7) control of raw materials, or excellent purchasing; (8) consolidation and monopoly; (9) quality of product; (10) research and experimentation; (11) price.

The more of these factors employed the greater should be the profits and their security. The value of each of these factors may vary in different companies. For example, the Ford Motor

¹ *Chicago Tribune*. Dec. 29, 1936. P. 21.

² L. C. Morrow, *Factory Management and Maintenance*. December, 1936. P. 35.

Company may have the most efficient production methods, while the American Telephone and Telegraph Company and the Standard Oil Company may secure their profits largely through monopoly and consolidation, and General Foods and Coca-Cola largely because of price. Knoeppel emphasizes¹ the service objective of business as an important method of making profits.

Dr. H. G. Moulton² has emphasized the fact that lower prices will expand the volume of sales without necessarily reducing the

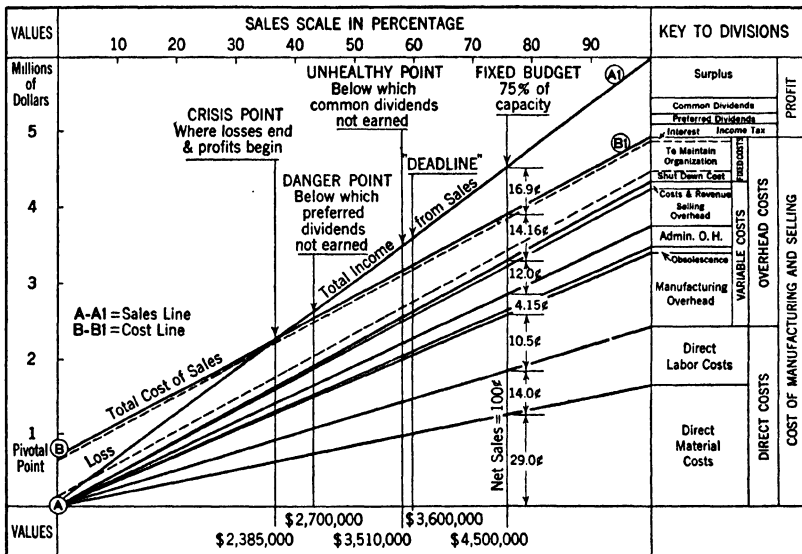


FIG. 35.—Profitgraph. (From: C. E. Knoeppel, *Profit Engineering*. New York: McGraw-Hill Book Co. 1933. Frontpiece.)

profits, and, indeed, will protect profits by the reduction of unit costs, which offsets the low prices.

Mr. Knoeppel emphasizes that profit planning and control are essential to the making of profit and constitute a definite part of management. In order to manage profits he uses the profitgraph,¹ a sample of which is given as Fig. 35. The development of the profitgraph is described in Mr. Knoeppel's book *Profit Engineer-*

¹ C. E. Knoeppel. *Profit Engineering*. New York: McGraw-Hill Book Co. 1935. 326 pp.

² H. G. Moulton. *Income and Economic Progress*. Washington, D. C.: The Brookings Institution. 1935. 191 pp.

ing.¹ Other methods of managing profits are by means of budgets,² profit and loss statements,³ balance sheets,³ and financial statements.³

SPECIAL ASSIGNMENTS

Ownership and Financing

1. Report on the types of ownership in one or several companies of which you know.
2. Report on the organization and activities of (a) holding companies,⁴ (b) business trusts, (c) joint stock companies, etc.
3. Report on the method of financing of one or more companies with which you are acquainted.

Accounting and Cost Accounting

4. Make a journal, ledger accounts, trial balance, and postings of the following transactions:
 - a. The proprietor pays into business \$1000.00 cash.
 - b. Buy \$100.00 worth of merchandise for cash.
 - c. Sell \$250.00 worth of merchandise for cash.
 - d. Sell \$10.00 worth of merchandise on credit.
 - e. Buy \$200.00 worth of merchandise on credit.
 - f. Pay the rent for one month, \$50.00 cash.
5. Report on "Standard Costs" by Charles Reitell in *Factory Management and Maintenance*, Vol. 93, No. 5, May, 1935, p. S-33, etc.

Wage Incentives

6. Report on "Measured Day Work" by R. H. Rositke, *Factory Management and Maintenance*, February, 1937.
7. Report on one or more of the following wage payment plans:

(a) Barth premium plan.	(d) Haynes manit system.
(b) Merrick multiple piece rate.	(e) Ficker machine rate.
(c) Wennerlund bonus plan.	(f) Diemer bonus and premium plan, etc.
8. Report on your own personal experiences with wage payment plans.
9. Report on the wage payment plan or plans of an individual company or department.

¹ C. E. Knoeppel. *Op. cit.* See also C. E. Knoeppel, *Managing for Profit*, New York: McGraw-Hill Book Co., 1937.

² For sample budget, a discussion of budgets, and a further treatment of profits see the section "Profits and Budgets" in the last chapter, on measures of management.

³ For samples and discussions of profit and loss statements, balance sheets, and financial statements, see Alexander Wall, *How to Evaluate Financial Statements*, New York: Harper & Brothers, 1936. A sample profit and loss statement of the Duncan Electric Company is given in the cost accounting section of this chapter.

⁴ See J. C. Bonbright and G. C. Means, *The Holding Company*, New York: McGraw-Hill Book Co., 1932.

Profits

10. List the principal companies of the United States which are commonly identified with each of the factors by which profits are made.

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- (4) CHARLES W. GERSTENBERG. *Financial Organization and Management of Business*. New York: Prentice-Hall. 1932.

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- (5) H. A. FINNEY. *Principles of Accounting*. New York: Prentice-Hall Co. 1934. (2 Vols.)
- (6) R. B. KESTER. *Accounting Theory and Practice*. New York: Ronald Press Co. 1933.
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- (8) G. C. HARRISON. *Standard Costs*. New York: Ronald Press Co. 1930.
- (9) CHARLES REITELL. *Cost Accounting*. Scranton, Pa.: International Textbook Co. 1934.
- (10) CHAS. F. SCHLATTER. *Elementary Cost Accounting*. New York: John Wiley & Sons. 1927.

WAGE INCENTIVES

- (11) C. W. LYTLE. *Wage Incentive Methods*. New York: Ronald Press Co. 1931. 465 pp.
- (12) NATIONAL INDUSTRIAL CONFERENCE BOARD. *Financial Incentives*. New York City. No. 217. 1935.

PROFITS

- (13) H. G. GUTHMANN. *Analysis of Financial Statements*. New York: Prentice-Hall. Revised Edition.
- (14) C. E. KNOEPPPEL. *Profit Engineering*. New York: McGraw-Hill Book Co. 1933.
- (15) ALEXANDER WALL. *How to Evaluate Financial Statements*. New York: Harper & Brothers. 1936.

CHAPTER V

MEN¹

Modern management of men involves the application of the scientific method to human problems. It collects facts and uses them for the purpose of preventing personnel difficulties from arising. It is preventive in nature. In employment work the facts are obtained about applicants before employment to prevent the hiring of a man unsuited for the work. Physical examinations and health procedures are maintained to prevent later physical difficulties on the part of the worker and the spreading of disease to the other workers. Safety activities attempt to prevent accidents before they can happen. Employee representation gives employees an outlet for grievances and complaints before a break between employer and employee occurs and difficulties ensue.

PERSONNEL MANAGEMENT

Personnel management is the application of the scientific method to the human problems of obtaining an efficient force adapted to the organization for which it was intended, of maintaining this force in relations mutually harmonious and profitable to employer and employee, and of making adequate provisions in caring for the personnel after it has served the organization over the period of greatest usefulness. To accomplish these ends, industry and business maintain the personnel activities and procedures given in Table VII, to the extent shown in the first percentage column. The personnel activities and procedures in particular companies, carried on by individual managers, will naturally vary according to the special nature and needs of the different companies. The following are some examples of personnel management maintained in particular companies.

The principal divisions of personnel management and the

¹ Parts of this chapter on Men were published in the special section on "Personnel Management" in *Factory Management and Maintenance*, December, 1936, pp. 334-44.

scope of each in the Commonwealth Edison Company¹ of Chicago are summarized as follows:

1. Office of the Manager of Industrial Relations.
 - a. Includes the general administration of all personnel activities and of the Employees' Suggestion System and Employees' Representation Plan.
2. Employment Division.
 - a. Recruiting and preliminary selection of employees.
 - b. Furnishing staff assistance to the Salary and Wage Administration Committees.
 - c. Maintaining employees' records.
 - d. Compiling statistical and other reports.
3. Employees Service Division.
 - a. Administration of the various employee thrift, benefit, and insurance plans.
 - b. Cooperation with the various employee social and recreational organizations.
4. Dean of Women's Office.
 - a. Employment of women.
 - b. Other problems relating to women employees.
 - c. Lunchroom.
 1. Preparing and serving daily luncheons and special dinners to employees at cost.
 - d. Library.
 1. Maintaining a suitable collection of reference books and magazines and providing a library service for the departments of the company.
5. Medical Division.
 - a. Physical inspection.
 - b. Visiting nurse service.
 - c. Surgical and first aid service.
 - d. Health promotion.
6. Training Division.
 - a. Functional supervision over supervisory jobs, and public-contact training.
 - b. Conducting company-wide training programs, such as management training.
 - c. Handling reimbursements for employees who have satisfactorily completed educational course in outside educational institutions.
7. Safety Division.
 - a. Functional supervision over safety work in the company.

The personnel management of the U. S. Gypsum Company² has the following divisions:

1. Obtaining quality personnel—employment.
2. Instilling a knowledge of the business—training.

¹Special description of the industrial relations activities of the Commonwealth Edison Company prepared for the author by G. W. Adrianon, Superintendent of the Employment Division.

²Given to the author by W. M. Morrison, Personnel Manager, U. S. Gypsum Co.

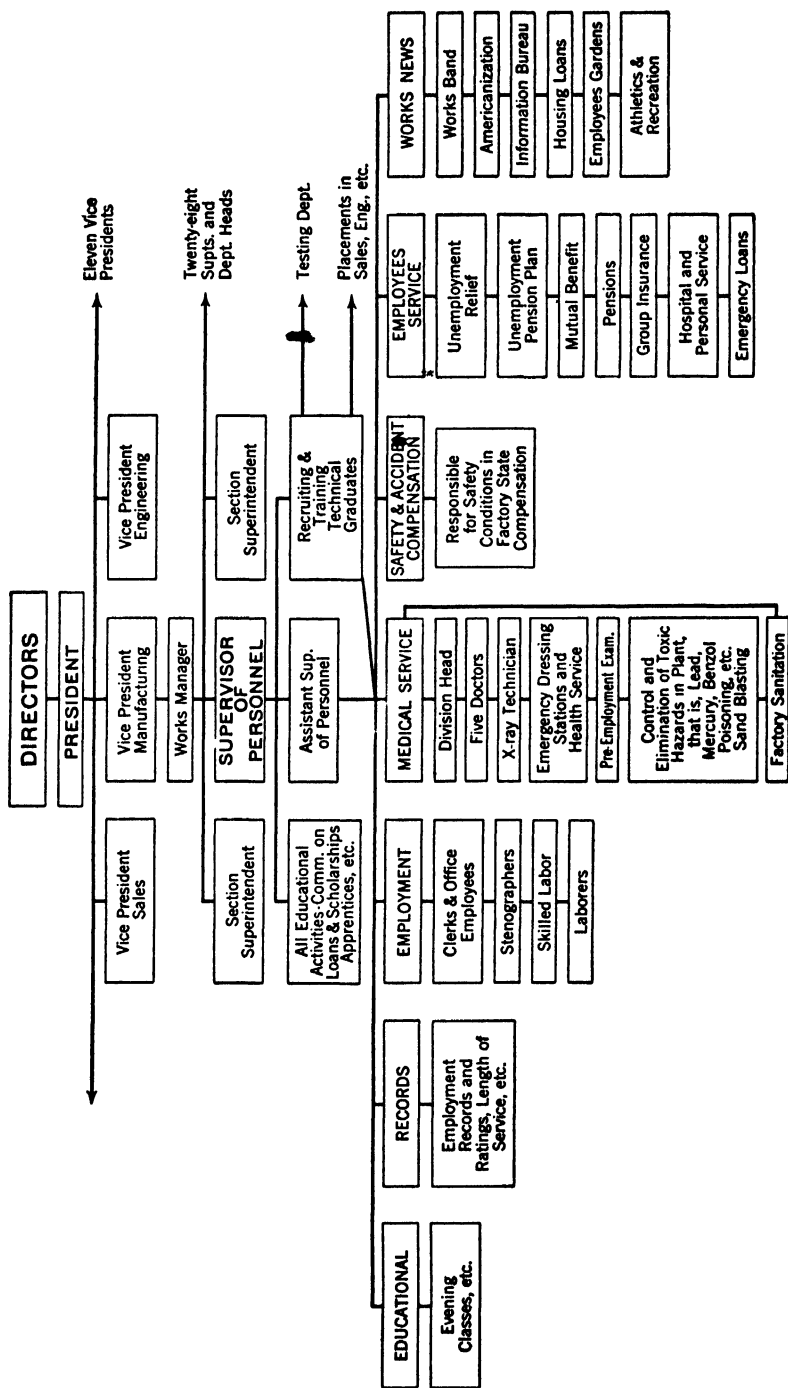


FIG. 36.—Organization chart of the Personnel Department of the General Electric Company, Schenectady, N. Y. (Prepared for the author by L. H. Means, Personnel Dept., March 7, 1933.)

3. Placing the man properly in the company—organization.
4. Maintaining adequate working conditions—working conditions.
5. Measuring performance with U. S. G. standards—production.
6. Paying for results—compensation.
7. Outside activities and relationships—welfare.

The personnel activities of the General Electric Company and the Procter & Gamble Company as well as their personnel organization charts are shown in Figs. 36 and 37.

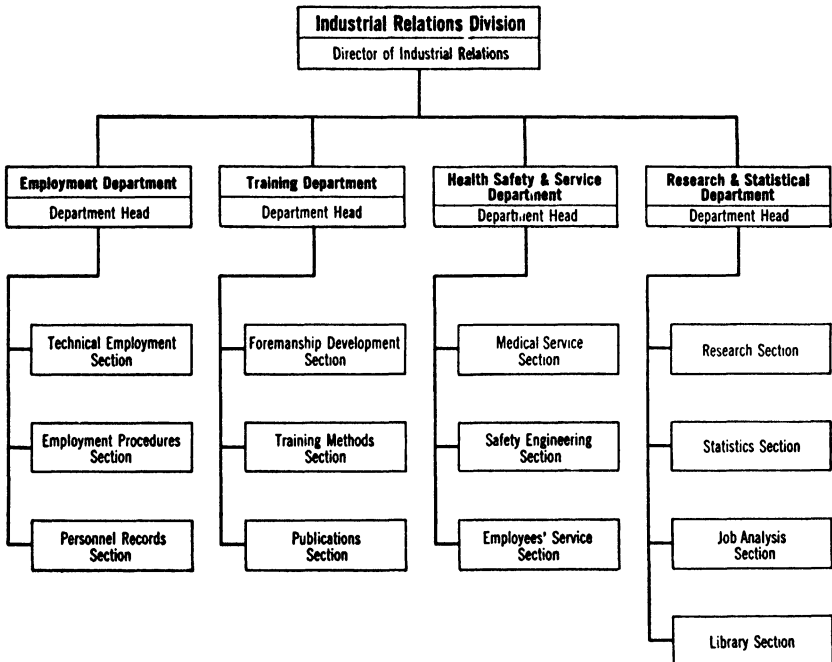


FIG. 37.—Industrial Relations Division of the Procter & Gamble Company. (Procter & Gamble Company, *Opportunities for College Graduates*. 1932.)

The somewhat varied nature of personnel activities in the different companies, a desire to know their exact status, and the need of a general over-all view and appraisal of personnel activities in industry led to a survey of these activities in 233 industrial and business concerns, the tabulated results of which are shown in Table VII, and some of the facts are given in the next few paragraphs of this chapter.

TABLE VII
STATUS OF PERSONNEL ACTIVITIES IN 233 COMPANIES*

Activities	Percentage of total		
	Maintain now	Dropped during depression	Considering adoption
EMPLOYMENT PROCEDURE			
Centralized employment.....	85.4	2.0	1.0
Centralized transfer.....	74.7	1.1	2.9
Centralized discharge.....	63.5	1.4	4.1
Interviews			
With applicants.....	90.6	0.5	...
Periodically.....	27.0	1.6	4.8
Upon leaving.....	69.1	1.2	3.1
Employment tests			
Intelligence tests.....	10.7	8.0	24.0
Trade tests.....	17.2	...	10.0
Clerical tests.....	28.8	3.0	6.0
Investigation of reference.....	69.5	1.9	0.6
EMPLOYER-EMPLOYEE DEALINGS			
Individual basis.....	43.3	...	...
Employee representation			
Joint committee or council.....	35.6	6.0	9.6
Employees' association.....	18.5	...	9.3
Union agreement.....	7.3	...	...
PERSONNEL MAINTENANCE			
Rating procedure			
Rating entering employees.....	34.3	...	10.0
Rating employees periodically.....	31.8	4.1	10.8
Rating foremen.....	21.9	5.9	15.7
Rating executives.....	13.3	6.5	12.9
Rating apprentices.....	29.6	10.1	7.2
Systematic promotion plan.....	27.5	6.3	4.7
Periodic wage adjustment.....	35.2	8.5	2.4
Wage payment plan			
Straight time rate.....	81.1	...	...
Straight piece rate.....	58.8	0.7	...
Premium or bonus plan.....	45.9	8.4	0.9
Group rate or bonus.....	34.3	8.8	2.5
Special bonuses.....	20.2	14.9	4.3
Time study for wage setting.....	68.7	1.3	1.9
Fatigue studies.....	25.3	5.1	6.8
Job analysis.....	53.2	2.4	6.5
Job specifications.....	39.5	3.3	13.0
Periodic labor audit.....	18.0	2.4	4.8
Dismissal compensation.....	22.7	11.3	...
Employment stabilization			
Spreading work.....	74.7	2.9	...
Five-day week.....	78.1	1.1	1.6
Unemployment relief.....	26.2	11.5	8.2
Diversification of product.....	27.9	...	...
Special training in versatility.....	12.0	3.6	3.6

* J. E. Walters, Purdue University, in collaboration with Research Staff of the National Industrial Conference Board (247 Park Ave., New York City). For details see the Conference Board's Bulletin, *Effect of the Depression on Industrial Relations Programs, 1934*, and J. E. Walters, *An Investigation of Personnel Administration in Industry Under the National Industrial Recovery Act*, Ithaca, N. Y.: Cornell University (thesis), 1934.

TABLE VII—Continued

Activities	Percentage of total		
	Maintain now	Dropped during depression	Considering adoption
PERSONNEL RECORDS			
Individual employee record.....	94.0	...	...
Periodic personnel report.....	40.3	2.1	2.1
Periodic employment report.....	57.1	2.3	0.8
Periodic health report.....	31.8	1.4	1.4
Periodic safety report.....	60.9	2.8	...
Labor turnover records.....	77.3	0.6	0.6
PERSONNEL RESEARCH.....	12.9	10.0	6.7
HEALTH AND MEDICAL SERVICE			
Physical examinations			
At time of employment.....	72.1	1.8	2.4
Periodically.....	38.6	2.2	2.2
First-aid work.....	86.7	...	0.5
Company dispensary.....	76.0	...	...
Hospital fully equipped.....	37.3	1.1	...
Special clinics.....	15.9	18.9	...
Plant nursing.....	57.1	4.5	2.3
Home or visiting nursing.....	30.9	6.9	...
Regular sanitary inspections.....	67.8	...	...
Rest periods.....	24.0	1.8	...
SAFETY-ORGANIZED ACCIDENT PREVENTION			
Constant attention to mechanical safe- guards.....	92.3	0.5	...
Safety education.....	75.1	0.6	0.6
Safety conferences.....	68.7	3.8	...
Safety posters.....	88.8	1.4	...
Safety competition.....	42.5	6.1	...
Safety committees.....	74.2	3.5	0.6
EDUCATION AND TRAINING			
Apprenticeship.....	45.5	16.0	2.8
Training on job.....	57.9	5.2	1.5
Foreman training			
Courses.....	20.2	46.8	10.6
Conferences.....	42.9	16.0	6.0
Committees.....	12.9	16.7	...
Industrial courses.....	12.0	35.7	10.7
Training high-school graduates.....	12.4	34.5	3.4
Training college graduates.....	14.6	44.1	5.9
General courses.....	5.6	30.8	7.7
Company library or reading room.....	32.2	5.3	1.3
PERSONNEL SERVICE WORK AND FINANCIAL BENEFIT ACTIVITIES			
Group life insurance.....	69.5	1.2	1.9
Mutual benefit association.....	57.1	0.8	1.5
Accident benefits.....	48.1	2.7	3.6
Sick benefits.....	52.8	3.3	5.7
Death benefits.....	50.2	1.7	2.6
Stock purchase plans.....	10.3	104.2†	25.0
Unemployment insurance.....	5.6	15.4	46.2

† More were dropped than are now in existence.

TABLE VII—Continued

Activities	Percentage of total		
	Maintain now	Dropped during depression	Considering adoption
PERSONNEL SERVICE WORK AND FINANCIAL BENEFIT ACTIVITIES—Continued			
Pensions			
Formal.....	17.6	7.3	19.5
Informal.....	33.0	5.2	...
Profit sharing.....	5.6	53.8	15.4
Savings plan.....	21.5	18.0	2.0
Loan plan.....	23.2	7.4	3.7
Credit union.....	10.7	8.0	12.0
Suggestion system.....	43.8	21.6	5.9
Home purchase plan.....	10.7	32.0	...
Company housing.....	21.5	...	...
Transportation facilities.....	5.6	15.4	...
Restaurant or cafeteria.....	53.2	20.2	...
Company store.....	14.6	14.7	...
Cooperative purchasing.....	9.9	13.0	...
Legal aid.....	21.9	...	...
RECREATIONAL ACTIVITIES			
Athletic teams.....	49.4	20.0	1.7
Athletic facilities.....	30.9	13.9	4.2
Social affairs.....	42.9	14.0	1.0
Dramatics.....	9.4	54.5	9.1
Musical activities.....	14.6	58.8	5.9
Club house or rooms.....	28.8	6.0	1.5
Employees' club.....	19.3	6.7	4.4
Company gardens.....	27.9	6.2	1.5
Picnics or outings.....	35.6	47.0	7.2
Noon-hour activities.....	16.3	31.6	...
Employee magazine.....	22.3	94.2	13.5
Vacations with pay			
Salaried employees.....	83.3	9.3	1.0
Wage earners.....	15.9	75.7	8.1
PERSONNEL STAFF			
Personnel director.....	51.1	3.4	0.8
Employment manager.....	68.2	4.4	0.6
Training director.....	12.4	27.6	3.4
Safety supervisor.....	57.5	5.2	...
Medical officer.....	61.4	0.7	...
Nurse.....	72.5	4.7	...

The principal reasons given for maintaining personnel and industrial relations activities were as follows:

REASON	PERCENTAGE OF 215 COMPANIES INDICATING REASONS
1. It improves employee-employer relationships.....	95
2. It improves the attitude of employees toward the company.....	90
3. It improves morale and good will.....	89
4. It reduces accidents.....	84
5. It reduces labor turnover.....	79
6. It secures a better type of employee.....	76
7. It reduces labor troubles.....	76
8. It improves the attitude of the community toward the company.....	73
9. It increases personal service to employees.....	73
10. It pays in dollars and cents.....	72
11. It stabilizes employment.....	68
12. It increases employees' efficiency.....	64
13. It increases production.....	56
14. It improves employees' finances.....	52
15. It counteracts union activities.....	40
16. It correlates union activities.....	16

The reason that personnel work pays in dollars and cents was not considered as the prime motive. However, the long-run pecuniary implications of this broader motive are obvious, and the author would like to emphasize that this work can pay in dollars and cents. Personnel work is a straight business matter. It is not a philanthropic or paternalistic phase of management. It should pay its own way. The total cost of personnel activities in 63 companies was \$14.06 per employee per year or 1.85 per cent of the pay roll. In the smaller companies employing from 1 to 750, the cost was \$26.66 per employee per year, and for companies above 750, between \$11 and \$12 per employee. The United States Bureau of Labor Statistics found the average cost of personnel work in 430 establishments in 1926 to be \$27.¹ The National Industrial Conference Board in 1927 found the average for small companies to be \$26.65.² The cost of personnel work correlates highly (coefficient of correlation, $r = 0.73 \pm 0.04$), with the number of activities maintained. A median of 52 activities (40 per cent) of the 128 activities investigated were carried on by the 62 companies reporting cost data.³

¹ United States Bureau of Labor Statistics. *Health and Recreational Activities in Industrial Establishments, 1926*. Washington, D. C.: U. S. Government Printing Office. Bulletin 458. 1928. P. 86.

² National Industrial Conference Board. *Industrial Relations Program in Small Plants*. New York. 1929. P. 40.

³ For costs of employment, medical training, safety service, and other personnel

Since one may question whether personnel work actually does pay to the extent shown, let us consider briefly how personnel work pays.

One of the chief reasons for the employment department is that it decreases labor turnover, preventing separations in good times and making wise layoffs during depressions. Excessive labor turnover, either separations or layoffs, is expensive to the company because of the cost of hiring, cost of training, extra labor cost, and extra investment cost. In bad times it involves expense to the company or the community to provide unemployment relief. For the company, the cost ranges from \$250 for a highly skilled employee to \$8.50 for ordinary labor in normal times. The estimated cost of labor turnover for the hourly rate employees of a single plant of a boiler manufacturer was figured to be \$95 per separation. The average turnover rate of 169 metal firms of 184,000 employees in 1926 was approximately 140 per cent. In 1926, labor turnover was about 50 per cent as judged from the Bureau of Labor Statistics. From these figures a labor turnover of 75 per cent would be about average. Some companies have been able to reduce labor turnover as much as 70 per cent. The American Steel and Wire Company had a labor turnover of 90 per cent in 1920 and 19 per cent in 1928. Therefore, it would not be unreasonable to expect, with the use of scientific employment methods, a decrease in labor turnover of 25 per cent. In a plant of 1,000 employees that would be a decrease in hiring, training, and firing or layoff of 250 employees. At an average of \$40 per employee that would mean a saving to the company, in the long run, of $\$40 \times 250$, or \$10,000 per year.

Disregarding all other reasons for having an employment department, that company could spend \$10,000 on employment and realize its money's worth. In that sense, then, the employment department would be paying for itself in dollars and cents.

The company would also be obtaining a more efficient force of workers for the other jobs in the plant. If the company obtained only 1 per cent more efficient employees by proper hiring, that 1 per cent increase in efficiency for the year would amount to some \$12,000 for the company. But let us forget that \$12,000 because of the increased efficiency through proper employment methods, and stick mainly to those activities which we can calculate more accurately.

activities see the special section, "Personnel Management," by the author, in *Factory Management and Maintenance*, December, 1936, p. 336.

Every company has a plan for paying wages. It is not unreasonable to expect by reconsideration of the wage setting and payment processes, such as from the straight hourly rate to an individual, group, or efficiency incentive plan, an increase of 2 per cent in efficiency. If half of the employees were included in the change it would be an average of 1 per cent increase. On the basis of the Industrial Conference Board's figures, let us consider an average day's wages at about \$4. With a saving of 1 per cent for 1,000 men the total would be 4 cents $\times$ 1000 or \$40 per day for the entire plant. For the year's period of 280 working days the total amount saved for the year would be \$40 $\times$ 280 days or \$11,200, which would be saved by personnel consideration of the proper wage incentives.

In many plants it is not unusual to grant employees a week's sick leave with pay. With the installation of health promotion activities by the company, it is not unreasonable to expect that absence because of sickness can be reduced two days per year per man, making the average sickness five days, or a saving of two days. For the 1,000 men that would be a saving of 2,000 man-days, at \$4 per day, or \$8,000. The health department then could be considered as worth a minimum of \$8,000 to the company, without even considering the improvement of general health and happiness, as well as the efficiency of all employees.

Most industrial concerns have some accidents during the year. There will be a greater number of lost-time injuries where safety education and activities are not promulgated. In a company of 1,000 without safety activities, 50 lost-time injuries per year easily could be expected to occur. According to the National Safety Council, companies have been able to reduce accidents from 90 per cent in the American Smelting and Mining Company to 27 per cent on the New York Central Lines. Let us take an average of about 50 per cent reduction. At that rate we would prevent, say, 25 lost-time accidents. Mr. Heinrich in the *Monthly Labor Review* of November, 1930, has given the total direct cost of an average injury as \$246. By preventing 25 accidents per year, an annual saving of 25 $\times$ \$246, or \$6,150, would result as well as the saving of human life and suffering.

Another company paid out \$1,700 in one year to employees for suggestions. They gave the employee 10 per cent of the saving resulting from the suggestions. In other words, that com-

pany saved \$17,000 that year from the suggestions of the employees. For the company of 1,000 employees it would not be unreasonable to expect to pay \$300 to employees for suggestions which, at 10 per cent, would be a saving of \$3,000 to the company. Certainly \$300 is not too much to pay for a \$3,000 saving, or a net saving of \$2,700.

In these calculations the increase in general efficiency of employees and the improvement of their morale have not been mentioned.

Allowing a large factor of safety, let us consider employee development through such activities as ratings, pensions, thrift plans, transfers, personnel records, and lunchrooms. Would it be unreasonable to expect one-half of one per cent increase in efficiency of the entire force? One company by giving free to its employees a good hot lunch increased the production of two departments 10 per cent during the afternoon. The lunch cost 35 cents, but the company made in increased production through increased efficiency nearly two times that amount. Then, through all these employee developmental activities there might be expected without unreasonableness an increase in efficiency of one-half of one per cent. That would mean another increase of \$6,000 for the plant of 1,000 men for the year.

An overall view of these activities would show the following savings or increases:

Employment (reduction of labor turnover) . . .	\$10,000
Change in wage incentive	11,200
Health service	8,000
Safety	6,150
Suggestion system	2,700
Employee development	6,000
Total	\$44,050

From the viewpoint of the directors, they could spend \$44,050 for personnel work: employment, wage changes, health, safety, suggestions, and employee development. Let us assume that they are spending \$27,000 for these services (the average cost in this investigation), in which case they would be making a profit of \$17,050 on their personnel activities. The personnel work would not only pay for itself in dollars and cents but would even be making a profit.

There may be too many ifs, ands, and assumptions in these cost calculations, but if personnel work is considered from a dollars and cents viewpoint, with reference to a centralized employment service, a modern wage incentive plan, a health and safety division, a suggestion system, employee developmental services, and the other personnel activities, it can be shown to pay.

Though personnel work does pay in dollars and cents, the principal method of proving its value is by the attitude, good will, and interest of employees. This shows that, in actuality, its financial value is not, in the largest number of cases, proved with very great accuracy from the standpoint of measurement,¹ and it also shows the need for a more definite method of appraisal. The fact that personnel reports are indicated frequently as a method of proving the value of personnel work emphasizes the need for the presentation of these reports with the utmost care. Some companies reported that they do not have to prove the value of their personnel work and that proof is unnecessary, which fact shows that if its value were actually proved in those companies the work would be more firmly founded. In addition, it is a challenge to find a more definite method of appraisal.

The high extent to which the companies carry on many of the personnel activities, as shown in Table VII, and the facts that some of these activities were maintained at an increasing rate during this depression, and that the personnel field in general has not decreased as much as general employment and pay rolls, indicate that employers have not lost sight of the value of handling adequately the human problems in industry. If the maintenance of such activities continues to increase, we can expect the future human problems in industry to be handled more adequately and thereby we can expect that industry will become an increasingly human and vital force in social advancement.

EMPLOYMENT

The effective selection of employees is one of the most important phases of the management of men. If an efficient employee

¹ Some measurements have been made on attitudes, such as given in the following, but were not found to be greatly used by the companies investigated. L. L. Thurston. "Attitudes Can Be Measured." *American Journal of Sociology*. 33(4). January, 1928. Pp. 529-55. W. Kornhauser and Agnes S. Sharp. "Employee Attitudes." *Personnel Journal*. 10(6). April, 1932. Pp. 393-404. Also the Procter & Gamble Co. of Cincinnati has measured the attitudes of its employees.

is hired, his management is easier than that of an inefficient one. If an inefficient employee is hired, even good management may not be able to manage well. In general, effective selection will result from the application of scientific methods to employment problems. As in the other phases of management of men, the application of scientific methods to selection applies more to group (personnel) efficiency than to individual efficiency. For example, the use of a good clerical test to employ clerks may not be effective with a particular applicant, but it may prove excellent in securing a higher percentage of efficient clerks from a group of 100 than if the test were not used. In other words, personnel activities should be looked upon as an aid in predicting group performance. With the use of the test the manager may select 75 efficient employees out of 100, whereas without the test he may select only 50. In this case he would be increasing the efficiency of his selection 25 per cent by the use of the test. The clerical test was used only as an example, but the same principle will apply to other employment and personnel activities.

The employment procedure generally involves the following:

1. The development of a source of personnel supply.
2. Interviewing.
3. Tests and examinations.
4. Selection.
5. Introduction to the job.

Before the proper selection of an employee can be made the manager must have a number of persons from whom to select. The better or more efficient the group from which he selects, the more efficient the person selected is likely to be. The two general sources of personnel supply are those from within the company and those from outside. From within the company a manager has the present employees who can be transferred and trained for the different jobs, the friends of present employees, and previous employees of the company. If the supply of efficient personnel available from within is not adequate, outside sources can be developed by considering the following: applicants who apply at the plant and by mail; advertising in newspapers, trade journals, and as a last resort, posters; the various schools and colleges; employment agencies; lodges, churches, trade and labor organizations; scouting; collective bargaining; and layoffs from other companies.

If a manager systematically develops the source of personnel supply by using as many of these sources as he possibly can, it is more than likely that he will have a better group of people from whom to select than if he were to take the first person who came along. For example, if he considers just the employees from within his organization he may not have as good a source as he would if he also considered the applicants who had previously applied from the outside. The systematic use of as many of these sources as possible results in the highest percentage of efficient employees as far as source of personnel supply is concerned.

After these sources have been developed, one of the first procedures is an interview with the applicants. As shown in a survey of 233 companies, 90 per cent of them interviewed applicants.

Interviewing.¹ Proficiency in interviewing can be learned. It is an art, not an exact science, and always involves the play of individuality and initiative. Fundamentally, the purposes of the interview are to find out facts, to inform the interviewee, and to motivate him. In the employment interview all three purposes should be realized. The interviewer should find out facts about the applicant, and he should inform the applicant sufficiently about the work being offered and the company to motivate the interviewee in or out of the company. In interviewing, the following instructional principles¹ have been found effective:

1. Know as many as possible objective criteria and subjective viewpoints about the interviewee in advance of the interview. Before an interview with an applicant, study his application blank and any other records or opinions that can be obtained in advance, as well as general information which may assist you in finding facts about him.

2. Prepare a schedule and list of questions for the interview, or have available job specifications of the work to be done. It is important and valuable to have a definite program for the interview.

3. Make appointments in advance wherever possible, for time is saved in seeing the interviewee promptly and in shortening preliminary explanations.

4. Provide privacy for every interview.

5. Take the interviewee's point of view. Try to put yourself

¹ Adapted from W. V. Bingham and B. V. Moore, *How to Interview*. New York: Harper & Brothers. 1931. This is an excellent book and is especially recommended.

in the applicant's place. Without that, there may be a misunderstanding.

6. Examine and discount your own prejudices. Are your ideas warped on any subject which you must discuss with the applicant? If so, try to keep the applicant from knowing them. Keep an open mind, which is indispensable to interviewers.

7. Gain and deserve the interviewee's confidence by showing evidence of genuine confidence and interest in him. One method is to establish pleasant associations and mutual confidence. Do not interview the applicant when he is angry, or when you are "peevish." Congenial fellowship develops a favorable attitude in both interviewer and interviewee.

8. Help the interviewee feel at ease and ready to talk. First, be at ease yourself and make it apparent. Begin with pleasant topics. Try to find mutual likes and interests.

9. Do not ask questions directly until you think the interviewee is ready to give the desired information and to give it accurately. Listening by the interviewer is very important. Let the interviewee tell his story. Then help him to supplement it.

10. Keep on the subject of the interview. When necessary ask a question or make a suggestion which will lead back to the general subject of the interview. The schedule of questions made out previous to the interview may assist in keeping on the subject. Take pains to phrase your questions so that they are easily understood. Make sure that the applicant understands them, possibly by asking him to give his ideas on them or to repeat them. Avoid implying the answers to your question. Give him a chance to express his own viewpoint in the matter. Look for and scrutinize the full meaning of each statement. Give the interviewee an opportunity to qualify his answers. Check his answers whenever possible.

11. Be straightforward and frank rather than shrewd and clever. Do not try to deceive or trick the interviewee by your questions. Tell him the purpose of the interview straightforwardly and frankly.

12. Avoid impertinence. Help the applicant realize his responsibility. Record all data from interview at once, or at the earliest opportunity. This can be done by following your schedule for the interview.

13. Allow sufficient time for the interview if possible. Do not rush it through. Get all the facts, yet keep control of the inter-

view. Keep the interviewee aware of the definite purpose which should be attained in the limited time. Watch for additional information and new leads in the interviewee's casual remarks. Confirm and summarize the interview. Check the results of the interview whenever possible. Place the information from the interview where it can be used later.

From the standpoint of the general purposes of the interview for employment the manager may be able to find out facts about the employee which will qualify or disqualify him for the work. He might give him such information about the company as will motivate him to seek further employment with the company or another concern. The ideal result of the interview would be that the interviewee is sufficiently motivated to make the proper decision himself as to whether he is or is not qualified for the work. If a manager or employer considers the principles given above, it is more than likely that he will have a more effective interview than if he does not.

Interviewing is also used to check periodically the attitudes of employees, and to discover difficulties in management which are indicated by employees leaving the organization. These interviews may aid in finding management difficulties and improving them and the morale involved.

During the interview a number of procedures may be used to aid the interviewer in controlling the interview. He may test the honesty of the employee by cross-questioning. However, this should be done in such a way, if possible, as to prevent the applicant from knowing that he is being cross-questioned. The courts have used this method effectively. If the applicant is aggressive in the interview, he might be put on the defensive by questioning. A question usually puts the applicant on the defensive to answer it. Besides those methods the interviewer may look for the causes of "defense mechanisms," apologies, etc., in the interview. However, all the interviewing procedure should be as free and easy as possible.

Though the interview should not be the entire basis for employment, it can be used to determine evident disqualification. To give an extreme example, an interviewer might readily determine whether a man is a ditch digger or not from his build, his dress, general make-up, etc. However, as most abilities and aptitudes center around the average, it is difficult to tell from a brief interview whether or not an applicant is suitable for the

work. For adequate selection, the manager must consider the various factors involved.

The personnel factors to be considered in selection are shown in Table VIII.¹ If an employer omits any one of these factors it may be that that one will cause him to secure a less efficient employee than he would have secured if he had considered all of them. From the methods by which these factors are determined as given in the third column of Table VIII, we can see that, in general, the principal methods of determining these factors are by the application blank, interviews, references, tests and examinations, and ratings. The application blank properly checked and verified should give educational and personal information about the applicant. In general, the interview may show an employer that the interviewee is stupid or mentally alert, at least during the interview. Of course, one way to tell whether a person has the intelligence and the ability to do the job is actually to try him on the job. If he does the work well, he is qualified from the standpoint of intelligence and ability; if he does not, he is not qualified. The introduction of the man to the job, trying him out, and training him for the work are usually expensive and inefficient if the man is not fitted for the job. If the employer can find tests, examinations, or other procedures which will predict a man's intelligence and ability to do the job before he is assigned to it, the employer could save that employment and training expense. This last idea has led to the use by some companies of tests and examinations to determine intelligence, abilities, and trade aptitudes. The many kinds of employment tests are classified according to the purpose of the test; the source of the ability tested; the proficiency or capacity necessary; the abilities measured, such as motor or intellectual abilities, attention, will, and emotional traits; the methods of presentation, such as oral, written, or performance tests; the type of response, such as free response and constrained response; and the methods of administration, such as individual or group. Hundreds of tests are in existence at the present time, and the fundamental requirement for any test is that it should measure objectively the ability, aptitude, or quality tested. This necessitates the performance of a certain task under standard conditions. In order to be objective, the test should be reliable and valid, that is, the

¹ J. E. Walters. *Applied Personnel Administration*. New York: John Wiley & Sons, 1931. P. 84.

TABLE VIII
PERSONNEL FACTORS TO BE CONSIDERED IN SELECTION*

Kinds of factors	Factors	How determined or measured
1. Mental	1. Appropriate intelligence for the job (1) Alertness (2) Adaptability (3) Judgment, etc. 2. Proper knowledge of job 3. Sufficient education and training	Mental tests, interviews, and ratings Trade tests and interviews Application blank, interview, and references
2. Physical	4. Good health 5. Fine physique (1) Height (3) Size (2) Weight (4) Texture 6. Strength, endurance, speed, and dexterity 7. Proper age, sex, color	Physical examination Physical examination Physical examination, strength, and special tests Interviews and application blank
3. Moral	8. Good character (1) Honesty (2) Truthfulness, etc. 9. Supporting habits (no bad habits)	Ratings, references, and interviews References, ratings, and interviews
4. Social	10. Appropriate personality (1) Industry (2) Cooperativeness, good attitude towards work, fellow workers, and last position, etc. (3) Initiative (4) Appropriate appearance 11. Helpful home life, family and community relations, and friends 12. Wholesome reasons for leaving last position 13. Lack of detrimental idiosyncrasies 14. Convenient location to work 15. Proper social class for work	Ratings, interviews, and references References and ratings Interviews Interviews References, ratings, and tests Interviews and references Interviews and references Interviews, ratings, and references Interviews and application blank Interviews
5. Combination of 1, 2, 3, 4, and others	16. Ability to do the job 17. Relevant experience 18. Personal data and experience 19. Proper interests	Trade tests and tryouts Application blank and references Interviews, applications, and references Tests and interviews

* J. E. Walters. *Op. cit.* P. 84.

test should be internally consistent and reliable within itself and should test what it is supposed to test. These requirements are determined by statistics.¹

An intelligence test attempts to measure the intelligence, mental ability, mental alertness, or ability to adjust to new situations. There are many different intelligence tests. Some of those used in industry are the Otis Self Administering Test of Mental Ability,² the Revised Alpha Examination,³ the Thorndike Intelligence Test, and the Kuhlmann-Anderson Test. Besides the general intelligence tests there are many tests of special abilities, interests, and personality, such as the O'Connor-Wiggly Block and Dexterity Test, the Stenquist Mechanical Aptitude and Assembly Tests, the Strong Vocational Interest Test, the Bernreuter Personality Inventory, and the Thurstone Personality Schedule.

In an attempt to determine a person's ability or capacity to perform a standard task in a certain trade, trade tests have been and are being developed.⁴ These tests may take the forms of oral, written, picture, or performance tests or their combinations. Trade tests are used more commonly than intelligence tests as shown in a survey of personnel activities in 233 companies. An extract from an oral trade test for a bench hand follows:

1. Q. What do you call a split pin used to keep a nut from working off?
A. Cotter.
2. Q. What do you call the first tap used to thread a hole in steel?
A. Taper.
3. Q. In what way are the invisible parts of a tool shown on a blue print?
A. Dotted line.
4. Q. What is the best kind of chisel to use to cut a key-way by hand?
A. Cape.
5. Q. What happens to a hole if one lip of a drill is ground off center?
A. Too large (oversize).

Written tests are similar to the oral except that the answers are

¹ For statistical methods see L. L. Thurstone, *The Fundamentals of Statistics*. New York: Macmillan Co., 1927; and H. E. Garrett, *Statistics in Psychology and Education*. New York: Longmans, Green & Co., 1926.

² Yonkers-on-Hudson, New York: World Book Co. 1929.

³ New York: Psychological Corp.

⁴ See trade questions and tests being developed by the Research Staff of the United States Employment Service, Washington, D. C. Also especially L. A. Thompson, Jr., *Interview Aids and Trade Questions for Employment Offices*, New York, Harper & Bros., 1936.

written. In the picture tests, pictures of tools, parts of the machinery involved, etc., are shown to the applicant, who is expected to name and explain them.

Performance tests involve the construction, assembly, or manipulation of a standardized part or task of the trade or performance of the same functions or operations as those found in the trade except on a model or miniature scale. Examples of trade tests are those for pipe fitter, machinist, and chauffeur. The pipe fitter's test involves the use of two heads, four elbows, eight pieces of pipe, and the pipe fitter's tools. The candidate is asked to make up a radiator coil. His proficiency is based upon the time required to put the coil together correctly. The ideal trade test would be a test that would require exactly the same mental, physical, and other requirements as the actual job, but in an abbreviated manner.

Strength tests measure the strength of hands and the back. The physical examination is given to determine the physical condition of the applicant. Rating scales are used to determine personality and character traits.

In general, the construction of tests involves knowledge and experience, and should not be attempted without proper training and education.

Although intelligence, ability, and trade tests may aid in selecting more efficient men, they should not be used as the entire actual basis for employment unless their reliability and validity have been proved to be sufficiently high to warrant such use. If test results are used *as an aid* in conjunction with the various other personnel factors to be considered in selection, the combined procedures should result in efficient selection.

After a number of applicants have been interviewed, tested, and examined, the employer has then to select the best one or ones. The object of this selection is to secure the most efficient man or men. This may be done effectively by making a list of the men and their scores, measurements, ratings, etc., on the various personnel factors. The total of these various factors for each man will be an indication of his qualifications for the job; the higher the total is, the higher, apparently, will be his qualifications for the job. The different essential factors will vary for different jobs. For example, in actual practice, intelligence may not be an asset for certain laboring jobs, because a man with high intelligence may not stay permanently on these jobs.

In general, however, the person or persons should be selected who are the highest on the greatest number of qualifications for that particular job. The most efficient person or group will usually be selected by this procedure.

In the past and even today some doubtful methods have been and are being used in selection, such as "character analysis," physiognomy, phrenology, and graphology. Although there may be something to them, their value has been doubted principally because they are ~~not~~ based upon scientific experimentation and verification.

After the employee has gone through the process of applying, being interviewed, tested, and finally selected through a consideration of the various personnel factors, he has yet to be introduced to the job. In many companies, even during the selection process, the history, policy, and rules and regulations of the company are explained orally or given in a printed form to the employees. Talks on loyalty, discipline, safety, and other personnel activities are given at that time. Many companies have issued employee handbooks which give information concerning hours of work, wage payment plans, vacations, attendance, safety, etc.

When employed, the man is usually taken by some person to the department in which he is to work and introduced to the foreman. After that introduction he is shown his locker and the wash room, and instructed in his work either actually on the job or, as is sometimes done, in a vestibule school, a separate room or place where he is tried out and instructed before he is placed in his regular work or production. The employee should be given a good first impression and made to feel at ease from the start because that beginning often affects his attitude toward his whole work with the company. After the instructional period is over, it is usually customary for the manager or a personnel representative to visit the individual after the employee has had an opportunity to become more or less settled. If any difficulties have arisen, the manager or personnel man can then take care of them in such a way that the man is permanently happily located in his job. Some companies even put new employees on a trial basis for several weeks or months; if they are satisfied and do satisfactory work during that time they are employed permanently.

EMPLOYER-EMPLOYEE DEALINGS

After a man is permanently employed, certain problems and difficulties usually arise in which he and his employer are mutually interested. As they are mutually interested, the best relationship which should exist between them is that of mutual cooperation and definite consideration of each by the other. Under the old type of management, the management gave orders and the employee obeyed them or quit. Today, after years of experience in joint relationships, modern management has come to know that greater efficiency can be obtained by dealing cooperatively with employees and providing methods of discussing and considering with employees those matters in which both are mutually interested, such as hours of labor, wage rates, working conditions, safety and accident prevention, promotion of health, and employee welfare. Modern Management has become quasi-judicial in nature. In recent years, the National Industrial Recovery Act and the Wagner National Labor Relations Act granted employees the legal right to self-organization, to bargain collectively through representatives of their own choosing, and to engage in concerted activities for the purpose of collective bargaining in matters of financial aid and mutual protection without any interference, coercion, or restraint from employers. Though the NRA has been declared unconstitutional by the Supreme Court, the Wagner Labor Relations Act has brought forcibly to the attention of employers the necessity of providing some plan of collective consideration of matters of mutual interest to employer and employee.

In general, there are three methods of employer-employee dealings: (1) the individual basis, (2) employee representation, and (3) collective bargaining through a trade or labor union.

In November, 1933, the National Industrial Conference Board investigated the types of employer-employee dealings in 3,314 companies and found that 46 per cent of the employees were being dealt with individually, 45 per cent through employee representation, and 9 per cent through organized labor unions.¹ In May, 1934, an investigation of the same companies disclosed dealings on an individual basis with 40 per cent of the employees; through employee representation, 50 per cent; and through organized labor unions, 10 per cent.¹ In April, 1935, the

¹ National Industrial Conference Board. *Conference Board Service Letter*. June 30, 1934. P. 42.

Bureau of Labor Statistics¹ found that 42.5 per cent of the employees in 14,725 companies were being dealt with individually; 30.2 per cent partly or wholly through trade unions; 7.4 per cent through both company and trade unions; and 19.9 per cent through company unions.

Dealing with employees on the individual basis seems to decrease, and that through employee representation seems to increase as the size of the companies increases, with the union agreements existing most frequently in medium-sized companies.²

As long as industry has existed, employers have dealt individually with employees. Throughout English and American history, we see individualism predominating through the laissez-faire idea with reference to industry. Under the individual dealings the employee bargains directly and individually with his employer. The relationship is a contractual one between each employee and his employer. All difficulties and misunderstandings are taken up and considered individually.

In the last several decades there has developed the employee representation type of employer-employee dealings, which is a formal representation plan for employer and employees to consider matters of mutual interest. It is an organized method of management for dealing with employees cooperatively and collectively. The organization of employees under employee representation plan is sometimes called a "company union."

One of the first employee representation plans was the Filene Cooperative Association of the William Filene's Sons Company of Boston in 1898. Other developments of this procedure came in the American Rolling Mill Company in 1904, in the Philadelphia Rapid Transit Company in 1911 in the form of the Mitten Management, in the John Leitch Plans in 1913 and 1914, and in the Colorado Fuel and Iron Company in 1915.

Employee representation probably received its greatest impetus during the World War. On April 8, 1918, the President of the United States established the National War Labor Board to settle labor disputes in industry. During its thirteen months of existence it made 520 formal awards, 125 of which called for the establishment of some form of employee representation.

¹ Bureau of Labor Statistics. *Monthly Labor Review*. Washington, D. C. December, 1935. Pp. 1445-6.

² Personnel Research Federation. *Personnel Journal*. New York. December, 1935. P. 196.

The principle of collective bargaining which the board used was somewhat similar to that found in Section 7-A of the National Industrial Recovery Act. This method of collective bargaining and employer-employee dealings was one of the chief contributions of the National War Labor Board. In recent years employee representation has grown as a result of the collective bargaining sections of the NIRA (7a) and the National Labor Relations Act.

Generally there have existed three types of employee representation plans: (1) the federal type, (2) the joint shop committee or works council type, and (3) the employees' association. The federal type is modeled after the United States federal government with a House of Representatives and a Senate selected by the employees who meet, discuss, and decide matters to be taken up with the management. There is sometimes a cabinet made up of the appointees of the management with whom these matters decided upon by the House and Senate are taken up. An example of this type of employee representation was that of the Goodyear Tire and Rubber Company, the by-laws of which are given in Appendix A1.

In the joint committee or works council type of employee representation, the employees elect representatives in each department who meet with an equal number of representatives selected by the management, which combined group jointly decides upon matters of mutual interest to employer and employees in that department. Then the departmental representatives select one representative from their number to represent them on the general joint committee or works council, which is again made up of an equal number of representatives of the employees and of the management. Under this plan if a difficulty occurs in a department it can be discussed by the joint committee in that department without being brought up before the whole council or joint committee of the company, unless it cannot be decided by the department. If a matter cannot be decided by the departmental committee, it goes to the works council for consideration. This procedure facilitates the handling of departmental matters before the whole company, and prevents bringing up matters of importance to only one department. However, the works council gives a final outlet for matters that cannot be decided by the departmental committee. Examples of companies using

the joint committee or works council type of employee representation were the DuPont Company of Wilmington, Delaware, and the Real Silk Hosiery Mills of Indianapolis, Indiana. The by-laws of the plan of the DuPont Company are given in Appendix A2.

When the NRA and the National Labor Relations Act were put into effect, the meeting of the representatives of the employees and management jointly in the joint committee type of employer-employee dealings was considered by some as preventing the employees from acting independently without interference from the management, a right which was given to the workers by these acts. Some said that when the representatives of management met with those of the employees, management would necessarily influence the decisions of employees. This led to the organization of employees' associations, which were organizations of the representatives of the employees only. Under this plan the employees elect their representatives to the association. The representatives of the association meet separately and without any representatives of the management being present. They consider matters of interest to them, make decisions, and select employees' representatives to take up these matters with the management for consideration, action, or arbitration. The Bendix Products Corporation and the Delco-Remy Corporation had such employees' associations. The by-laws of the plan of the Delco-Remy Corporation are given in Appendix A3.

The matters considered by an employee representation plan rank as follows:¹

1. Individual grievances and complaints.
2. Health and safety.
3. General wage increase or decrease.
4. Wage rates for specific occupations.
5. Changes in weekly or daily hours.
6. General rules and regulations.
7. Methods of sharing or rotating work.
8. Discharge of an employee or employees.
9. Rules of seniority.
10. Type of wage payment.

In the Bethlehem Steel Company the most frequent matters considered have been employment and work conditions, wages,

¹ United States Bureau of Labor Statistics. *Monthly Labor Review*. Washington, D. C. October, 1935. P. 872.

piece work, bonus, and tonnage schedules; safety and prevention of accident; and practices, methods, and economy.

Employee representation, in general, usually results in a decrease of the number of labor disputes, disturbances, and difficulties. It gives the employees representation in the matters of mutual interest to them and the management. It improves morale and the *esprit de corps* among the employees, and thereby makes for more efficient production. It gives the employee an opportunity to have a voice in matters in which he is vitally interested. It gives to the management a means of cooperating with the employees, improving morale, and instructing employees in the policies and methods of the company. In the past some managers have thought that employees would want actually to manage the company. Experience has shown that what they principally want is cooperative consideration in matters of mutual interest.

In general, however, industrial management prefers to deal with employees through employment representation or on the individual basis in preference to dealing through organized trade unions. Their reasons for this are many. Management considers them to be as follows:

1. That dealing with the union means loss of authority and control, loss of time for decisions and the resulting delay in action by the management, which usually means loss of discipline.

2. That the unions restrict output and require uniform wages and hours.

3. That a union representative of the employees is an outsider who does not know local company conditions; and that the labor union tries to force general conditions which will not fit a specific company.

4. That employees pay high dues to the union, an outside organization, instead of small or no dues to the "company union."

5. That employees belonging to a union feel loyalty to the union instead of to the company, and tend to consider the company as an enemy of the employees, thereby increasing antagonism toward the company and loyalty to the union.

6. That some organized trade and labor unions introduce radical and communistic elements and a tendency toward racketeering and graft.

7. That union leaders work more for their own profit from membership dues than from loyalty to the union. (Some managers contend that union organizers get "so much per head" for new members and that those organizers are selfish and do not care very much about profits for the employer, but want to "run" the company.)

8. That the unions lack excellent leadership and good management because employers select the best leaders for the company management.

9. That the union promotes strikes.

10. That whereas the unions contend that the interests of the employees and employer are not mutual, management contends that they are.

11. That only about 10 per cent of all the employees in manufacturing concerns are organized in unions and that that 10 per cent tries to run the affairs of the 90 per cent who are not in unions and causes labor troubles when most of the 90 per cent do not want labor difficulties.

12. That the union closed shop makes a monopoly and keeps the non-union worker from the right granted by the Constitution of pursuing a vocation of manual labor of his own choice.

From the above statement of opinion, we can see that management has its points of view and reasons for preferring to deal individually and through employee representation rather than through organized trade unions. Young managers should recognize these viewpoints and reasons. However, there are two sides to every question and the unions have their points of view, so let us consider them and their development.

As the development of unionism in England has been the forerunner of unionism in America, it may be well to consider briefly the developments in both countries.

The *laissez-faire* doctrine which dominated England in the first quarter of the nineteenth century had its effect upon the trade unions by the repeal of the Combination Acts in 1824 and 1825 and by the passing of laws which enabled trade unions to exist if their activities were restricted to an agreement upon their own wages or hours. A great stimulus was given thereby to the organization of trade unions. In 1859 a further change in the law made it legal for employees to combine in demanding a change in wages or hours and still larger numbers of trade unions were formed as a result. The increase in numbers was accompanied by disorders. Many Parliamentary commissions made investigations only to the result of the benefit of the unions in the passing of the Trades Union Act in 1871 which declared that trade unions were not to be declared illegal because they were in restraint of trade, and that they could have their funds protected by law, and also hold property. This act contained a number of vague terms, and after considerable agitation the Trades Union Act of 1875 was passed, which declared that no action committed by a *group* of workmen was punishable unless the same act was criminal if committed by a single individual. By these acts the legality of trade unionism was established and much of the popular disapproval consequently disappeared. Labor unions were even preferred in some industries. Approval

of the unions continued, and by the last decade of the nineteenth century they were an integral part of the regularly established institutions of the country, about 20 per cent of the adult male working force being union members.

Although the unions enjoyed a favorable position, opposition did occur in the Taff Vale Railway Company vs. the Amalgamated Society of Engineers case in 1901, following a railway strike. The union in this case was held liable for damages and costs for breach of contract and loss of property and business. The unions opposed this decision and won by means of the election of 1906 in securing the passage of the Industrial Disputes Act of that year. This act absolved the union and its members from any pecuniary responsibility for acts which, connected with trade disputes, caused a breach of an employment contract or hindrance to the business of another person. Courts could not entertain suits by members of trade unions under certain conditions, and the sympathetic strike was included in the term "trade disputes."¹

The Trades Union Act of 1913 authorized the unions under certain conditions to maintain and use political funds. The Railway Dispute of 1919 and the Coal Dispute of 1920 brought forward the Emergency Powers Act of 1920, which allowed the government to declare a state of emergency applicable to strikes. The Labour Party, financed largely by the unions, was strong, but the coal strike of 1926 weakened its influence to the extent that the Trade Disputes and Trades Unions Act of 1927 was passed.

This act of 1927 was based upon the following principles:

(1) A general strike is illegal, and no man shall be penalized for refusing to take part in it. (2) Intimidation is illegal. No man shall be compelled by threats to cease work against his will. (3) No person shall be compelled to subscribe to the funds of a political party unless he so desires. (4) Any person entering the established civil service of the Crown owes an undivided allegiance to the state.¹

In America the development of unionism has had a more difficult road than in England. Although there was an organized effort on the part of wage earners to improve their standards of living in the first part of the nineteenth century, the organization of labor in America proceeded more slowly than the growth

¹ H. A. Millis, "British Trade Disputes and Trades Unions Act." *Journal of Political Economy*. Vol. XXXVI. No. 3. June, 1928.

of industry. A wage earner could easily take up free land and become his own employer if working conditions did not suit him. In the early 1830's the labor movement changed from the old mutual insurance and benefit organizations to trade unions. Although there were earlier attempts to make national unions flourish, the National Labor Union, organized in 1866, was the first one of importance. It grew rapidly at first, and possibly helped to improve working conditions to a limited extent until among other things it took up political activities. The National Labor Union was succeeded by the Knights of Labor, which was organized in 1869 and grew to a membership between 600,000 to 700,000 in 1886. Because of neglect of the trade structure of its organization, internal dissensions, and the formation of heterogeneous groups with frequently antagonistic purposes, its membership declined to 100,000 in 1898, and its influence almost disappeared. In 1886 the American Federation of Labor was organized, and the membership grew from about 300,000 in 1899 to more than 4,000,000 in 1920, principally under the leadership of Samuel Gompers.

The unions in this country, while tending to eschew political action since the 1880's, have exerted some influence upon the federal government in regulation of industry and labor. A National Bureau of Labor was created in 1884 to gather labor information, and as early as 1888 a law was enacted for the settlement of railway disputes by arbitration. In spite of the fact that the Sherman Act was understood by labor not to apply to the activities of labor combinations, and in spite of the fact that the Clayton Act declared that labor organizations *per se* were not conspiracies in restraint of trade, the courts often construed the Sherman Act as an interdiction against strikes and boycotts.

American labor law rests on a combination of common law precedents, statutory enactments, and judicial interpretations. What would be lawful in one jurisdiction would be unlawful in another; therefore the legal status of labor has many ramifications. The principal practices of organized labor to accomplish its ends are organization and collective bargaining, strikes, boycotts, and picketing.

Early associations of workers under the English common law were treated as conspiracies¹ when they sought "unlawful" ends

¹ J. R. Commons and J. B. Andrews, *Principles of Labor Legislation*. New York: Harper & Brothers. 1916. P. 91.

or resorted to "unlawful" methods. In the United States this doctrine of conspiracy was accepted in rather unqualified form until about the 1840's.¹ Emphasis has been placed upon the rights of workers to bargain individually.

The status of the so-called "yellow dog" contract has been held that federal statutory enactment prohibiting discharge of workers on common carriers engaged in interstate commerce, because of union affiliation, was in violation of the fifth amendment as in the *Adair* case;² that a state statute forbidding employers to make employees give up union affiliation was interdicted by the fourteenth amendment in the *Coppage* case;³ and that the employer had a property right in such contracts entitling him to certain equitable relief as in the *Hitchman* case.⁴

The Norris Federal Anti-injunction Bill of 1932 declared the "yellow dog" contract contrary to public policy, but while withholding equitable and legal protection did not especially outlaw it.

Anti-trust legislation (the Sherman Act and the Clayton Act especially) was used by the courts against labor unions as organizations in restraint of trade, examples being the *Danbury Hatters' case*,⁵ the *Loewe Brothers Company* award of damages against the union for losses caused by a strike, and the *Coronado case*.⁶

The legality of the strike depends upon its objects and methods; if these are legal then the strike is legal.⁷

The secondary or compound boycott is generally held illegal, as it was in the *Danbury Hatters' case*,⁵ the *Buck Stove case*,⁸ the *Duplex Printing Company case*,⁹ and the *Bedford Stone case*.¹⁰

Picketing is usually considered illegal if it involves coercion, intimidation, or other violent means, as it was in the *Tri-City*

¹ *Commonwealth v. Hunt*, 4 Metcalf III (1842).

² *Adair v. The United States*, 208 U. S. 161 (1908).

³ *Coppage v. Kansas*, 236 U. S. 236 U. S. 1.

⁴ *Hitchman Coal and Coke Co. v. Mitchell*, 245 U. S. 229 (1917).

⁵ *Loewe v. Lawlor*, 208 U. S. 274 (1908), 235 U. S. 522 (1915).

⁶ *United Mine Workers v. Coronado Coal Company*, 259 U. S. 344 (1922).

⁷ *Sherry v. Perkins*, 147 Mass. 212.

⁸ *Gompers v. Buck Stove and Range Co.*, 221 U. S. 418 (1911).

⁹ *Duplex Printing Co. v. Derring et al.*, 254 U. S. 443 (1921).

¹⁰ *Bedford Cut Stone Co. v. Journeymen Stone Cutters' Assoc.*, 274 U. S. 37 (1927).

case.¹ Injunctions have been used as a legal device against unions to an increasing extent in the last twenty years, and damage suits, the older remedy, have not been uncommon, as in the Debs case² and the Buck Stove case.³

In spite of its many difficulties, unionism in this country grew⁴ rather rapidly from 1910 to 1920, when it was at its height,

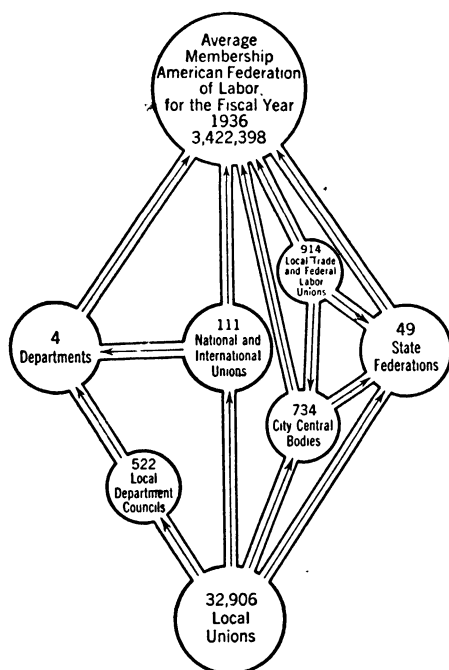


FIG. 38.—The organization structure of the American Federation of Labor. (From: *Report of the Proceedings of the Fifty-Sixth Annual Convention of the American Federation of Labor*. 1936. P. 43.)

the American Federation of Labor having 4,000,000 members. After the war it declined rather rapidly until in 1926 there were only 2,803,966 members and in 1933 only 2,126,796. Then it rose again to 3,045,347 in 1935, and 3,422,398 in 1936, when it was organized as shown in Fig. 38.

¹ *American Foundries v. Tri-City Council*, 257 U. S. 184 (1921).

² *U. S. v. Debs*, 158 U. S. 664 (1895).

³ *Gompers v. Buck Stove and Range Co.*, 221 U. S. 418 (1911).

⁴ For an extended discussion of the rise and fall of union memberships see Leo Wolman, *Ebb and Flow in Trade Unionism*, New York, National Bureau of Economic Research, 1936.

From the organization chart, Fig. 38, it can be seen that there are several classifications of unions. The principal ones are (1) the trade or craft unions, and (2) the industrial unions. The craft union is an organization of workers in a similar craft or trade such as carpentry, painting, and plumbing. The industrial union includes workers of an industry such as railroads or mining. Within the ranks of the American Federation of Labor there has been considerable conflict between these two types of unions. Under the NRA the emphasis was placed upon organizations by industries, which led to a growth of the number of Federal Labor Unions in the A. F. of L.

This new emphasis upon industrial unionism led to the organization of the Committee for Industrial Organization (C. I. O.) under the leadership of John L. Lewis, president of the United Mine Workers. This committee believed that the A. F. of L. was not promoting the organization of workers by industries sufficiently to meet the modern needs of labor in industry as a whole. In 1936 the C. I. O. promoted a program of organizing the automobile, steel, glass, and other industries into industrial unions without the approval of the A. F. of L. This led to the suspension from the A. F. of L. of the United Mine Workers and the nine other industrial unions of the C. I. O.

This suspension was continued at the November, 1936, annual meeting of the A. F. of L., but the ten unions were not expelled. This left a way open for an amicable solution later. However, the C. I. O. continued independently to try to organize labor by industries, especially the automobile, steel, and glass industries. This led to many strikes in these three industries in the early part of 1937.

The declaration of the Supreme Court of the United States on April 12, 1937 that the National Labor Relations Act was constitutional gave added impetus to the Committee on Industrial Organization, The American Federation of Labor, and other unions to organize workers. The Act, often called the Wagner Act, was passed in 1935 "To promote equality of bargaining power between employers and employees, to diminish the causes of labor disputes, to create a National Labor Relations Board and for other reasons."

Under this Act, employees have the right to self-organization, to form, join, or assist labor organizations, to bargain collectively through representatives of their own choosing, and to en-

gage in concerted activities for the purpose of collective bargaining or other mutual aid or protection. The Act declares as unfair labor practices for an employer (1) to interfere with, restrain, or coerce employees in the exercise of those rights, (2) to dominate or interfere with the formation or administration of any labor organization, (3) to discriminate against an employee because of membership in any labor organization, and (4) to refuse to bargain collectively with representatives of his employees.

Representatives elected by the majority of the employees are the representatives in the unit of representation: Provided, that any individual employee or a group of employees have the right at any time to present grievances to their employer.

Many disputes and "sit-down" strikes¹ followed the declaration of the Wagner Act as Constitutional.

A "sit-down" strike by the United Automobile Workers' Union occurred in the plants of the General Motors Corporation in January and February of 1937.

The union wanted:

1. A national conference with the international union.
2. Abolition of piece work.
3. Thirty-hour week and six-hour day.
4. Establishment of minimum rate of pay "commensurate with an American standard of living."
5. Seniority.
6. Reinstatement of "unjustly discharged" employees.
7. Recognition of the U.A.W.A. as the "sole bargaining agency between the General Motors Corporation and its employees."
8. Mutual agreement on speed of production.

The General Motors Corporation replied with the following data:

1. A total of \$120,000,000 had been appropriated to continue production in the company's plants during the slack season.
2. Employees had received a \$10,000,000 bonus and wage increases totaling \$34,000,000.
3. Working hours for the last year had averaged 40.2 weekly.
4. The November average wage was 78.6 cents an hour.
5. The payroll increased from \$143,000,000 in 1932 to \$360,000,000 in 1936.
6. Conditions were comparable with any in the same industry throughout the country.

¹ In the "sit-down" strike the workers remain or "sit down" at or near their jobs in the plant but do not work until an agreement is made between the management and the union.

The Corporation gave its position on the union's demands as follows:

1. General Motors will not recognize any union as the sole bargaining agency for its workers, to the exclusion of all other. General Motors will continue to recognize, for the purpose of collective bargaining, the representatives of its workers, whether union or non-union.

2. Work in General Motors plants will continue to depend on the ability and efficiency of the worker—not on the membership or non-membership in any labor organization whatsoever. This means that you do not have to pay tribute to anyone for the right to work.

3. General Motors will continue to pay the highest justifiable wages in the future, as it has in the past, and just as it is doing at present. It believes in high wages. It is justly proud of its record in that respect.

4. General Motors standard work week will continue to be forty hours. Time and a half will be paid for overtime.

5. Seniority rights will be observed under the rules laid down by the Automobile Labor Board appointed by the President of the United States in March, 1934.

These rules are recognized as fair and just to all workers and permit no discrimination against any worker on account of any organization membership.

The Corporation officials also contended that the workers were occupying the company's plants by unlawful trespassing since the workers were no longer actually employees of the company.

After many conferences between state and governmental officials and representatives of each side the strike between General Motors and the union was settled as follows:

Agreement entered into on this 11th day of February, 1937, between the General Motors Corporation [hereinafter referred to as the "corporation"] and the International Union, United Automobile Workers of America [hereinafter referred to as the "union"]:

1. The corporation hereby recognizes the union as the collective bargaining agency for those employees of the corporation who are members of the union. The corporation recognizes and will not interfere with the right of its employees to be members of the union. There shall be no discrimination, interference, restraint, or coercion by the corporation or any of its agents against any employees because of membership in the union.

Negotiate Feb. 16

2. The corporation and the union agree to commence collective bargaining negotiations on Feb. 16 with regard to the issues specified in the letter of Jan. 4, 1937, from the union to the corporation, for the purpose of entering into a collective bargaining agreement, or agreements, covering such issues, looking to a final and complete settlement of all matters in dispute.

3. The union agrees to forthwith terminate the present strike against the corporation and to evacuate all plants now occupied by strikers.

4. The corporation agrees that all of the plants which are on strike or otherwise idle shall resume operations as rapidly as possible.

5. It is understood that all employees now on strike or otherwise idle will return to their usual work when called and that no discrimination shall be made or prejudices exercised by the corporation against any employee because of his former affiliation with, or activities in, the union or the present strike.

6. The union agrees that pending the negotiations referred to in paragraph two there shall be no strikes called or any other interruption to or interference with production by the union or its members.

7. During the existence of the collective bargaining agreement contemplated pursuant to paragraph two, all opportunities to achieve a satisfactory settlement of any grievance or the enforcement of any demands by negotiations shall be exhausted before there shall be any strikes or other interruption to, or interference with, production by the union or its members. There shall be no attempt to intimidate or coerce any employees by the union, and there shall not be any solicitation or signing up of members by the union on the premises of the company. This is not to preclude individual discussion.

Will Dismiss Injunction

8. After the evacuation of its plants and the termination of the strike the corporation agrees to consent to the entry of orders dismissing the injunction proceedings which have been started by the corporation against the union, or any of its members, or officers, or any of its locals, including those pending in Flint, Michigan, and Cleveland, Ohio, and subject to the approval of the court to discontinue all contempt proceedings which it has instituted thereunder.

The philosophy of trade unionism and its developments¹ considers that unionism is a historical product brought about by the conditions under which it has found and does find itself. The common viewpoints of unions are considered to weld their members into a permanent social force working for a higher standard of living. Unions believe that in order to accomplish their aims they must have sufficient power and force to control their wants. This, they contend, can be accomplished principally through organization of large numbers of workers with sufficient funds to back up their demands. They believe in standardizing or limiting accomplishment to prevent too rapid work, because they contend that they have found that fast work will cause employers to lower wages and thereby lower the standard of living of the average worker. Likewise they contend that the increased efficiency of the few means less wages and less work for all. Therefore, they oppose the piece rate system because they believe that

¹ See R. F. Hoxie, *Trade Unionism in the United States*, New York, D. Appleton & Co., 1931.

it will eventually lower the wages of the few who cannot maintain the fast pace. Uniform accomplishment for a given amount of wages is their ideal, because not only they but also the employers know definitely what they are getting for their money. They desire increased wages for all for increased efficiency. They wish to keep the level of wages as high as possible because wages tend to level themselves to the lowest paid or weakest worker. Therefore, keeping the lowest worker as high as possible, they contend, will keep up the average. They believe that, by making wages uniform, the general level of wages will be kept higher than otherwise. They have certain rules of organization which they consider must be enforced if they are to win. They object to the non-union worker, or "scab," because he does not play the game and follow the rules for their common good. As their wage represents their standard of living, it is the most vital matter to them, and they naturally wish to protect it and stop the intrusion of the "scab," even if it requires force. Hoxie compares the "scab" to the person who would reveal the signals to an opposing school just before an important football contest.¹

The unions oppose employee representation, the company unions, for the reasons which they have given in the following comparison between a company union and an A. F. of L.² union.

THE COMPANY UNION

1. Is formed by the company to prevent organization in a real union.
2. Is favored by employers because they know there is nothing to fear from such unions.
3. Can be destroyed by the employer at any time, since he runs it.
4. Is paid for by the employer and controlled by the employer.
5. Charges no dues and makes no contribution to general improvement in working conditions.
6. Does not secure higher wages or better working conditions.

THE A. F. OF L.

1. Is formed by the employees themselves to secure better working conditions.
2. Is opposed by employers because they know that such unions will secure better working conditions for their workers.
3. Can never be destroyed so long as it is actively supported by all union members.
4. Is paid for by the union members and controlled by the union members.
5. Charges dues which help directly to build nation-wide organization and to bring about labor laws to protect workers.
6. Does secure higher wages and better working conditions, as is clearly shown by the history of the American Federation of Labor.

¹ R. F. Hoxie. *Op. cit.* P. 16.

² American Federation of Labor. Washington, D. C. October, 1934.

7. Is not a true agency for collective bargaining since employee representatives under company union plans are required to follow the instructions of the management.

8. Is not able to bargain in the true sense of Section 7 (a) because when the company bargains with the company it does not bargain with the workers but with itself.

9. Is limited to one shop, plant, or establishment, while employers themselves are so organized on a nation-wide basis in trade associations, that individual groups of employees are powerless.

7. Is a true collective bargaining agency which negotiates with the management as directed by the union members upon questions of wages, hours, and working conditions.¹

8. Is chosen by the workers under Section 7 (a) to represent them in collective bargaining.

9. Is affiliated with and supported by the American Federation of Labor, which is a nation-wide organization, giving protection to all workers against organized employers.

Unionism, being a historical product, can be changed then, only by changing and controlling the conditions which have made its ideals and actions what they are. Improved management with adequate consideration of the human elements involved and the provision for proper wages and working conditions should aid in this matter.

With reference to unionism and industrial management, William Green, president of the American Federation of Labor, has said:

Wage earners are real partners in the production enterprise. Management plans and provides materials but it is the producing workers that must carry out work orders and create the product or service as it is sold to the consumer. These workers make just as real an investment to industry as do those who invest capital. The rights which grow out of their investment it is the business of the unions to establish and maintain. The union is the business organization of the wage earners set up for the purpose of promoting their interests and protecting their rights. The union has management problems just the same as does business. In meeting these management problems policies are evolved and practices developed. Some of the problems are limited to business, some are social, and some are political.²

Many wonder what the trend of employee-employer dealings may be, if the organization of workers into national labor unions continues and increases with the aid of governmental favor³ and in spite of industrial managements' opposition.

¹ For model labor union agreement suggested by the American Federation of Labor see Appendix B.

² Letter to the author dated Sept. 24, 1934. Quoted with Mr. Green's permission.

³ This favoritism may be recognized by the order of the National Labor Relations Board for the International Harvester Company at Fort Wayne to dissolve its "Industrial Council Plan" in November, 1936, in favor of the International Union of United Automobile Workers.

Recent developments in parts of the automobile industry and especially the following seven-point agreement between Local No. 9 of the United Automobile Workers and the Bendix Products Corporation after a nine-day "sit down" strike, and lockout, might indicate the trend. The seven points of the agreement are given in the following new policy (November 25, 1936) of the company:

The Company agrees to supplement its statement of policy with the following points:

1. The company shall cooperate with Local Union No. 9, by agreeing to take back all of the employees on the employment roll as of November 16, 1936, without discrimination or loss of seniority rights, as far as practicable to the extent that there are jobs for them.

2. All employees shall be back at work in their former places not later than Monday morning, November 30, 1936.

3. The Company is recognizing Local Union No. 9 as the bargaining agent for its membership, and all other employees who shall choose to avail themselves of its services, on all matters pertaining to their working conditions. The Company shall negotiate with the Committee of Local Union No. 9 on request on all matters with respect to rates of pay, wages, hours of employment, or other conditions of employment; and shall not finally agree with any other group with respect to such matters without also having reached an agreement on the same matters with the representatives of Local Union No. 9. The Company shall continue to recognize individual's rights.

4. There shall be established a Board of Review to which any member of the Union or any other employee who secures the consent of the executive board of Local Union No. 9, who is dissatisfied with the decision of the Personnel Director may take his complaint or grievance. This Board shall be composed of three members of Local Union No. 9 who are not concerned with the presenting of complaints and three members of the executive staff of the Company not connected with the shop management. The Local Union No. 9 shall nominate six persons for this committee from which the Company shall choose three. The Company shall nominate six persons from which Local Union No. 9 shall choose three. Any employee whose case is being considered by the Board shall have the right to be represented by one or more members of the executive board of Local Union No. 9.

5. Men laid off by reason of reduction of forces shall be given at least one day's notice in advance of such lay-off.

6. Employees notified to report for work when no work is available shall be provided with a minimum of two hours' employment instead of one hour as in the past.

7. In order to carry out the spirit and intent of this agreement, the management agrees that it will cooperate with Local Union No. 9 in jointly considering all proposals which may be submitted by Local Union No. 9 to the management after resumption of work.

Items 5 and 6 were given voluntarily by the Company without any request having been made by any employee.¹

PERSONNEL MAINTENANCE

Promotion. After an employee has been hired, he must be promoted, transferred, or maintained on the job. If he does hard work of excellent quality and quantity, performs more and better work than is required, has exceptional knowledge, ability, and personality for the job ahead, has a good understudy, and is more valuable to the company in the job ahead, he will be promoted if opportunities are available. This promotion may take the form of advancement in wages, responsibility, decreased working time, better working conditions, or increased security. He may be promoted by the three-position plan of promotion or the multiple chain promotion plans.²

If he is not doing well in one job he may be transferred to another.

Ratings. In order to find out how the employee is progressing or to determine his present status for future development many companies use rating scales. Some develop these scales themselves. A good plan for the development of a scale is to obtain, from the persons who will do the rating, a statement of the personal qualities or traits and types of behavior which they consider essential to successful performance in that company, to tabulate the traits given, and to devise a graphic rating scale, consisting of the trait name and its definition, followed by the types of behavior by which the trait is judged, graduated from lowest to highest.

Rating scales are used in industry to develop the employees' personality, to make comparison between employees, to show the progress of individuals, and to improve the morale of the group. The General Electric Company bases its promotion greatly upon ratings and finds the use of the rating scale an important management procedure. Examples of rating scales used in industry are those of the DuPont Company reproduced as Figs. 39 and 40-41.

The DuPont Company uses the personnel rating report, Fig.

¹ Given to the author by Geo. Weber, personnel director of the Bendix Products Corp., in a letter dated Dec. 18, 1936, along with the various other factory rules and regulations of the company.

² For descriptions of these plans see J. E. Walters, *Applied Personnel Administration*, New York, John Wiley & Sons, 1931, p. 99.

39, for all men in supervisory positions, and the employee record rating Fig. 40-41, for all plant operatives. The time interval be-

Form EV-1104 GM-5-35

PERSONAL RATING REPORT

E. I. du Pont de Nemours & Company

NAME _____ POSITION _____ AGE _____

DEPARTMENT _____ DIVISION _____ PLANT OR OFFICE _____

Please judge this employee on the qualities listed below. Each line is a continuous scale from low to high, divided into eleven spaces. Note that the lowest rating is not sub-divided, whereas the higher ratings are divided into two or three degrees. Place a check (✓) in the space above the horizontal line (not on a dividing line) which most nearly expresses your judgment on each quality. If the employee performs no supervision, do not rate on SUPERVISORY ABILITY.

The definitions covering the several qualifications and the considerations underlying them have been designed to convey as nearly the same meaning to all concerned as possible. However, if ratings are made by more than one individual within a jurisdiction, a complete understanding should be reached between them as to the application of the rating scale.

PERSONALITY: Consider the effect of his personality upon people. Be careful not to over-emphasize first impression.	Certain disqualification.	Unfavorable impression.	Nothing outstanding.	Favorable impression.	Exceptionally good personality. No doubt about it.	Consider the employee's work during the past year and check by a check (✓) whether he has done such, remained satisfactory or been absent in each of the qualities listed to the left. Has Improved Little of No Change Has Gone Back
QUANTITY OF PRODUCTION: Consider the volume of work produced under normal conditions. Disregard errors.	Very slow worker.	Volume below average.	Average.	Volume not good volume.	Good worker. Usually good producer.	
QUALITY OF WORK: Consider system and accuracy of work regardless of volume.	Work almost worthless.	Frequent errors.	Normal accuracy.	Very few errors.	Exceptionally accurate, probably no errors.	
INDUSTRY: Consider manner in which he gets on the job. Is he easily interrupted or does he have power of concentration?	Easily interrupted.	Requires considerable supervision.	About normal.	Ready worker. Good concentration.	Very independent and concentrated.	
TRADE KNOWLEDGE: Consider acquaintance with requirements of job gained through experience, general education, specialized training.	Inadequate knowledge.	Requires considerable coaching.	Fair knowledge.	Good training and experience.	Exceptionally thorough.	
ABILITY TO LEARN NEW DUTIES: Consider the speed with which he acquires new tasks and new knowledge. Consider also ability to retain this knowledge.	Very slow to learn. Poor memory.	Requires frequent instruction.	Average instruction required.	Learns readily. Good instruction.	Requires practically no instruction. Very quick to grasp new ideas.	
JUDGMENT AND COMMON SENSE: Does he think intelligently and make his decisions logically?	Generally unsatisfactory.	Induced to be misled.	Fair.	Judgment usually logical.	Thinks clearly and logically. Outstanding.	
INITIATIVE & CREATIVENESS: Consider ability to think along original lines, to handle assignments without detailed instruction or supervision and how often he makes suggestions for improvement.	None.	Hardly above average.	Some initiative occasionally.	Above average.	Initiative resulting in frequent savings in time or money.	
CO-OPERATION: Consider manner of handling business relationships.	Very poor co-operation.	Shows reluctance to co-operate.	Acceptable.	Gets along well with associates.	Gets out of the way to co-operate.	
POTENTIALITY: Consider his possibilities for advancement. How near is he to the limit of his efficiency?	Has stopped growing.	Has limit.	Questionable.	Promising future.	Exceptionally good possibilities.	
HEALTH: Consider its effect on his work aside from attendance.	Very poor; health serious handicap.	Health below normal; reflected in work.	Occasionally affects work.	No noticeable handicap.	Exceptionally good health. Lots of energy.	
SUPERVISORY ABILITY OR LEADERSHIP: Consider his ability to organize a group to get the maximum efficiency without friction. (Do not rate unless employee exercises supervision.)	Lacks qualities necessary to exercise supervision.	Inadequate supervision.	Nothing outstanding.	Effective supervision.	Very informal and effective leadership.	

(NOTE: Please list here any physical handicaps such as poor eyesight, poor hearing, loss of limb, etc., which may unfavorably affect his work.)

SIGNATURE (INDIVIDUAL MAKING RATINGS)

APPROVED

TITLE

DATE

TITLE

DATE

(OVER)

FIG. 39.—Personnel Rating Report of the E. I. du Pont de Nemours & Company.

tween ratings which they are using on these forms is one year for the personnel rating report and approximately four months for the employee record rating. These forms are made out by

Regularizing Employment. Many companies find it difficult to maintain a regular flow of work throughout the year or years. They are finding that the regularization of employment requires planning and wise management. During the depression following 1929, the spreading or sharing of the work available over the largest practical number of employees was an effective means of keeping employees off relief and at work. Many adopted the five-day week. Some provided unemployment centers and relief. Others diversified their product and developed new products through research. By these means employers were able to keep more employees regularly at work.

Handling Personnel. In the maintenance of personnel, whether it be rating, regularization of employment, or any other phase of the management of men, the recognition that persons are individually different should be present. Individual differences are always important considerations in managing people. Each person has some good qualities and some bad, but most of them center around the average. These individual differences occur because of inheritance, environment, and ancestral influences, as they are marked by differences in race, color, family characteristics, sex, maturity, and training.

Concerning the predominance of influence of environment and heredity in their effect upon people and their individual differences, Jennings,¹ after years of experimentation and study on the problem, says:

Characteristics do not fall into two mutually exclusive classes, one hereditary, the other environmental. A given characteristic may be altered by changing the genes; and this is the ground on which it is called hereditary. But the same characteristic may be altered by changing the environment; and this is the ground on which it is called environmental. The genes supply one set of conditions for development, the environment another set, and there is no necessary difference in kind between them. The characteristic produced may be changed by adequate alteration of either set. From the nature of a distinctive characteristic, it is not possible to decide whether it is due to diversity of genes or

¹ H. S. Jennings. *The Biological Basis of Human Nature*. New York: W. W. Norton & Co. 1930. Pp. 134 and 215. Also see Raymond Pearl, "Biology and Human Progress," *Harper's Magazine*, January, 1936 (No. 1028), p. 227.

to diversity of environment, since the same peculiarity may be due in different cases to either set of causes. The question as to which is the decisive factor in any given case is always one for objective determination by experimentation. . . .

It appears indeed probable, from the present state of knowledge and the trend of discovery, that the following sweeping statements will ultimately turn out to be justified:

(1) All characteristics of organisms may be altered by changing the genes; provided we can learn how to change the proper genes.

(2) All characteristics may be altered by changing the environmental conditions under which the organism develops; provided that we learn what conditions to change and how to change them.

(3) Any kind of change of characteristics that can be induced by altering genes, can likewise be induced (if we know how) by altering conditions. (This statement is open to more doubt than the other two; but it is likely eventually to be found correct.)

These hereditary and environmental influences make differences in human motives and desires. People have physical, mental, moral, and social needs, which motivate them to satisfy their desires. For example, they want to eat when hungry, drink when thirsty, secure more air when the supply is inadequate, secure rest when tired, get sleep when drowsy, secure warmth when cold, escape when frightened, and be relieved when in pain. These desires cause a man to satisfy his needs by collecting and hoarding, by fighting, by interfering with and overcoming resistance, by securing approval of others, by being a member of a group. Needs and desires are also greatly influenced by the group. Each person gratifies his desires or adjusts himself to them by such means as "defense" or "escape" mechanisms, etc. Many persons have some thwarted desires or personality defects which if handled sympathetically and expertly can often be removed by getting rid of or exposing the cause. A positive attitude or the substitution of an aggressive approach may overcome the difficulty.

One can usually handle people better if he realizes that there is always a reason for a person's acting as he does and that usually this reason can be discovered and corrected. Probably the greatest principle of handling people is the recognition that *men are feeling individuals as well as thinking people*. Courteous consideration of their rights and feelings is essential. They prefer praise as an incentive rather than blame, and dislike bluffing. However, praise for good work combined with blame for poor work may make for the greatest efficiency. The wise manager

will avoid making promises unless they are absolutely necessary, and will always recognize the worker's viewpoint. Men prefer uniform standards of personal dealings.

Laird¹ investigated the reasons why we don't like people and gave the ten most important ones in the form of the following questions:

1. Can you always be depended upon to do what you say you will?
2. Do you go out of your way cheerfully to help others?
3. Do you avoid exaggeration in all your statements?
4. Do you avoid being sarcastic?
5. Do you refrain from showing off how much you know?
6. Do you feel inferior to most of your associates?
7. Do you refrain from bossing people not employed by you?
8. Do you keep from reprimanding people who do things that displease you?
9. Do you avoid making fun of others behind their backs?
10. Do you keep from domineering others?

R. B. Hersey² after much research in the field of psychology of workers gives the following seven qualities as essential for the manager who endeavors to individualize the treatment of his workers:

1. First of all—a sense of humor.
2. The intelligence to understand reality and the courage to face it.
3. The ability to follow his reason instead of his emotions.
4. A sense of fair play.
5. The courage to stand up for his convictions and yet see the other fellow's point of view.
6. The capacity of adjusting himself to changing conditions.
7. A realization of the fact that life is a long-run process and that the emotional disturbance caused by the crisis of the moment must be discounted.

F. J. Roethlisberger³ gives the following five rules for leaders:

1. He should listen patiently to what his subordinate has to say before making any comment himself.
2. He should not be too ready to suggest or imply judgments of value regarding his subordinate's overt or verbal behavior.
3. He should not argue with his employees.
4. He should not pay exclusive attention to the words used by the employee.
5. He should listen not only to what a person wants to say but also to what he does not want to say or cannot say without assistance.

¹ D. A. Laird. *Why We Don't Like People*. New York: The Mohawk Press, 1931.

² R. B. Hersey. "Psychology of Workers." *Personnel Journal*. Vol. 14, Nos. 7 and 8. January and February, 1936. P. 295.

³ F. J. Roethlisberger. "Leadership to Ensure Collaboration." *Personnel Journal*. Vol. 14, No. 9. March, 1936. Pp. 317-18.

Webb and Morgan¹ analyzed the strategy which famous men used in handling people. After reading this the author endeavored to put down the principal strategies used, as follows:

1. Be careful of details in dealing with people.
2. Assist outstanding leaders.
3. Emphasize the superior qualities of those who resent you.
4. Make it easy for others to cancel their obligations to you.
5. Make your affairs of personal interest to those with whom you deal. Learn other persons' hobbies and be interested in them. Be posted about others before meeting them, and respect their customs.
6. Approach others through their own experience and needs.
7. Let the other fellow do the talking about himself (or rather make him do it, and show his thoughts first).
8. Try to induce others to participate in your plans. Ask others for advice about them. Consider others important in your affairs.
9. People's wants are different. Make appeals in different ways. Anticipate their wants.
10. Always work for "yes" answers. Word questions, etc., to require answer of "yes." Don't argue. Yield to small issues to save large ones. If the main issue is in doubt delay it. Give as many persons as possible opportunity to air grievances.
11. In disappointing someone shield his vanity and play on his ego. Make listeners feel clever, and that others esteem them.
12. Make your cause more important than personal interests.
13. Share the limelight with subordinates. Give them more credit than is due them. Help shoulder their mistakes.
14. Learn why others do things (off guard). Strutting and boasting often means some inferiority. Discount first impression.
15. A pleasing personality results usually from a deep and sincere interest in and liking for other people and their interests.
16. Repeat verbally what others desire (write it if possible).
17. Compliment others in the way that pleases them. Indirect compliments are usually excellent.
18. Establish a reputation in a certain field or of a certain kind as well as for honesty. Be especially modest about things done, yet plan for promotion and self-advancement when time arises by gaining the attention of the right person.
19. Break a rule if it is honest, safe, wise, and protects superiors.
20. Show people things or plans that they can see with their own eyes and in such a way that they can see and understand them easily in the light of their own experience.
21. Guard all secrets and confidences closely. Learn to conceal thoughts and feelings from others. Start the other fellow talking by asking questions when you do not wish to talk.
22. Make people laugh by the right kind of humor. Make the joke on yourself or an imaginary person.

¹ Developed from *Strategy in Handling People* by E. T. Webb and J. J. B. Morgan, Chicago, Boulton, Pierce & Co., 1930.

23. Do not argue with an angry person; to keep silent and ignore him is better. Keep calm when others are "losing their heads."

24. If others impose beyond reasonable limits, fight.

Besides the methods of maintaining personnel previously mentioned, an employee likes to know that what he does and accom-

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FIG. 42.—The Studebaker Corporation Employee Record Card.

plishes is known and is made a matter of record. If a record is kept the employee, as a rule, will have a better attitude toward higher accomplishment and a greater dislike for misbehavior. This warrants the maintenance of a *personnel record* of each employee. This record should contain, as a minimum, the employee's name and address, date and place of birth, nationality, color, marital status, previous experience, education, health record, training, personal references and ratings, name of person

to notify in case of emergency, service record, remarks, and other personal information pertinent to the company.

Samples of the personnel records of the Studebaker Corporation and the Socony-Vacuum Corporation are shown as Figs. 42 and 43.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32								
EMPLOYEE'S RECORD SOCONY-VACUUM CORPORATION																														PHOTOGRAPH IF AVAILABLE									
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Other, Fraternal and Military Organizations: _____															Telephone: _____																								
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PRINCIPAL EXPERIENCE																																							
Company										Address										Business					Dates of Emp.					Position					Remarks				
Medical Examinations — Dates and Results: _____																																							
Qualification Based on Firm _____ Rights from References Received: _____																																							

FIG. 43.—The Socony-Vacuum Corporation Employee's Record Card. (Record of employment in the Company, etc., on the reverse side.)

Besides individual personnel records an industrial concern may need to have other employment and personnel records, such as health, safety, training, and service records and reports.

TRAINING AND EDUCATION

Most persons in industry wish to know how to do their work excellently and to have a thorough knowledge of and training in that work. Industry is coming to realize that training and education of its employees are essential to the highest efficiency.¹ This training and education in industry usually involves training on the job, apprenticeship, foreman training, industrial and general

¹ For the effect of training upon production see L. P. Alford, *Laws of Management*, New York, Ronald Press Co., 1928, pp. 169-73.

courses, training of high school and college graduates, and provisions for a company library or reading room. When a man is introduced to the job he should be trained by the management in that job. If he is experienced, that training will be less, but there is always something new about a new job, whether it is the same type of work as the man had previously performed or not. This training is usually done by the foreman or by an instructor whose sole job it is to train new employees. It may be that the new employee is entirely inexperienced, which may necessitate an apprenticeship, whereby a regular program of training is provided to make the novice into an experienced worker, as, for example, machinist and toolmaker apprenticeships. Oftentimes these inexperienced men are put on as helpers to experienced workers and help them until the job is learned. After they have learned how to perform the job and pass certain examinations or tests, they are rated as regular machinists, toolmakers, etc. Some workers are trained in vestibules or separate rooms on separate machines from those in production. Then when they are found to know how to do their job they are put on production.

What might be considered the next higher level of training is *foremanship training*, which involves courses, conferences, or discussions upon the work that the foreman performs. A general conception of subjects taught in the foremanship training courses may be gathered from the programs in the following two companies: The American Rolling Mill Company has the following subjects in its foreman training program: (1) introduction, (2) history of the company, (3) incentives, (4) opportunity for advancement, (5) living and working conditions, (6) quality and service, (7) ethics in business, and (8) application of Armco policy. The Douglas Aircraft Company divided its foreman training program into the following headings: (1) exploration and planning, (2) cooperation, (3) cooperation between departments, (4) quality, (5) waste, (6) interest in the job, (7) solving problems by conference. (Another outline for a foremanship training program might be the subjects given in the Table of Contents of this book.)

The following is an outline of the executive training program of General Motors Corporation:¹

¹ Given to the author by George Coburn, Personnel Director, Delco-Remy Division, General Motors Corporation, Anderson, Indiana.

SECTION A. MANAGEMENT AND THE EXECUTIVE JOB.

1. The place of management in modern industry.
2. Principles of efficient organization.
3. Analysis of the executive job.

SECTION B. PLANNING.

1. Planning in an industrial enterprise.
2. Planning in the department.
3. The development of planning ability.

SECTION C. QUALITY CONTROL AND WASTE ELIMINATION.

1. The control of quality.
2. The control of scrap.
3. The control of waste.
4. What is inspection?
5. The inspection and salvage departments.

SECTION D. EQUIPMENT.

1. The fundamentals of equipment control.
2. Tool control.
3. The tool and maintenance departments.

SECTION E. BUILDING AND MAINTAINING THE ORGANIZATION.

1. Building the department organization.
2. The personnel department.
3. The control of labor turnover.
4. Proper supervision.

SECTION F. PRINCIPLES OF HANDLING MEN.

1. Personnel relations in industry—historical evolution.
2. Dealing with men—individual differences.
3. Dealing with men—human motives and desires.
4. Dealing with men—influence of the group.
5. Dealing with men—problems in human behavior.
6. Dealing with men—intelligence and training.
7. Handling men—getting along with people.
8. Handling men—difficulties with subordinates.
9. Handling men—giving and receiving orders.
10. Incentives—employee morale and morale control.

11. Securing cooperation.

12. Judging and rating men.

SECTION G. EMPLOYEE RELATIONS.

1. The background of employee representation.
2. Types and objectives of employee representation.
3. Results obtained with employee representation plans.
4. Plans of employee representation in General Motors.
5. The executive's relationship in employee representation plans.

SECTION H. INCENTIVES.

1. Wages.
2. The relation of the executive to wage questions.

SECTION I. POLICIES.

1. The executive and company policies.

SECTION J. SAFETY.

1. The safety program.
2. The problem of workmen's compensation.

SECTION K. JOB STUDY.

1. The methods of work department.
2. Principles of job study.
3. Time and motion study.

SECTION L. TRAINING.

1. The problem of training in industry.
2. Training and the department.
3. Methods of applying training.

SECTION M. HOUSEKEEPING.

1. Industrial housekeeping.

SECTION N. FUNDAMENTALS OF ECONOMICS.

1. Development of economic organization.
2. Modern economic organization.
3. Elements of economics.

SECTION O. FINANCIAL ORGANIZATION AND CONTROL OF BUSINESS.

1. Invested capital.
2. Borrowed capital.
3. Financial analysis.

SECTION P. BUDGETS.

1. Business conditions.
2. Forecasting.
3. Departmental budgets.

SECTION Q. DEPARTMENTAL COST CONTROL METHODS.

1. Departmental cost reports.
2. Direct materials cost.
3. Direct labor cost.

4. Departmental expenses.
5. General overhead.

SECTION R. PERSONAL CHARACTERISTICS.

1. Personal analysis.

SECTION S. GENERAL.

1. The requirements of modern industrial leadership.

The Studebaker Corporation asked their foremen and executives what they really needed in the way of training and what difficulties and problems they were faced with, and then based their foremanship training upon the replies. The Western Electric Company interviewed a large number of their employees to determine their attitude and feeling towards their foremen. From the difficulties and problems which the employees indicated, the company devised an excellent training program. Any foremanship training program, or any education or training, should be adapted to the particular company.

Many industries visit high schools and colleges and employ their graduates and train them in the work of their company. High-school graduates are sometimes trained for foremanship and specialized work, and college graduates for minor and other executive work. The training program for college graduates usually involves about six months to two years, during which time the graduates progress through a series of work stations or departments where they secure all the pertinent information relative to the varied work and different departments of the company. This is often supplemented by reading and study assignments. In some of the larger corporations they may be assigned to different plants as well as different departments for a program of work. In some of the companies these men just observe the duties of the different departments, especially for sales training; in others they actually do the work. Graduates may also be placed on testing the various types of equipment manufactured, as exemplified by the General Electric Company Test Course. In many of the companies who train college graduates, the outstanding employees who are not college graduates are also selected for the same or a similar training program. In addition to the training of college graduates some companies have executive training programs involving conferences on and the study of the executives' work. In addition to company training programs, generalized subjects, like mathematics, English, and generalized courses fundamental to the work of the company, such as electricity in electric companies, are offered.

In the Westinghouse Electric and Manufacturing Company a

full technical course can be obtained through cooperation with the universities in the city in which the company is located. Some companies cooperate with the grammar and high schools and work out educational programs and night classes for their employees. Others ask graduates of high schools and colleges in their own company to give advanced courses to the employees.

The Philadelphia Rapid Transit Company in order to set up a needed educational and training program asked the employees what they wanted and needed in the way of educational training. From the replies the company developed a training program which the employees wanted and which, incidentally, related more closely to the particular company than the officers of the company had expected. The practice of making a survey of what is wanted and needed seems to be an excellent principle for adapting training and education to the company. Companies are cooperating more than formerly with local schools and colleges for their educational and training work.

Training from the psychological viewpoint involves certain learning processes. For an employee to learn methods or processes it is necessary that his attention be gained and kept. As attention depends on change in position, strikingness, size, definiteness of form, and repetition, it is important that the teacher take cognizance of these factors in order to keep the workers' attention; for example, keep the idea "moving" by changing the aspects or viewpoint of the thing being learned. Interest is important and is usually obtained by giving information about the thing to be learned. The attention having been gained, certain procedures facilitate learning, namely, mental exercises, frequency and recency of learning, association, intensity of learning, and a good effect of learning. To apply these: the worker must really exercise his mind on the matter to be learned, do it frequently, not let it be forgotten too soon, associate it with knowledge and material which he has already learned, and do it intensely and with as pleasing a result as possible. A worker usually learns something better if it is presented to him in the way in which he is accustomed to thinking about it than if it is presented in a way foreign to him. One worker may learn directly to the point while another may take a roundabout mental path to learn the same thing. One may learn better by dealing with objects, another through pictures, and another by reading or words. The typical worker will usually learn rapidly

at first (assimilation); this initial rise in the curve of learning is generally followed by a plateau and then a rapid rise to expertness. The test of an expert manager or teacher is to bring the pupil beyond the plateau of learning. This can often be accomplished by studying the individual worker and by the establishment of incentives, giving praise and blame, and applying the various other personnel and psychological factors.

Besides these there is a certain methodology in actually carrying on the training. A glimpse of what industry is actually doing may assist in the development of this field.

The Western Electric Company¹ studied the factors affecting the production of a group of workers from 1927 to 1932. These included physical, psychological, and social factors. The effect of the following physical factors were investigated:²

1. Changes in the length of the working day.
2. Changes in the number of working days in the week.
3. Working days with and without rest pauses.
4. Frequency of changes in type of relay to be assembled.
5. Changes in the quality of the parts supplied.
6. The number of hours during which the operators were in bed on the previous night.
7. The effect of vacations and holidays, both in anticipation and retrospect.
8. The periodic illnesses of the workers.
9. The daily, weekly, and annual cycles.
10. Changes of temperature and of relative humidity.

The conclusion reached concerning these physical factors was that their effect was slight or negative. The contention of the investigators was that the physiological reserve compensated for physical changes in their physical circumstance.

The effect of character and social relationships of the workers and the mental attitude and human relationships was also investigated. The results of the investigation of the human factors warranted the following conclusion:³

Two major generalizations apply to the behavior of this group of workers from 1927 to 1932.

In the first place, significant changes in work behavior can almost always be traced to changes in mental attitude rather than to changes in physical circumstance.

¹T. N. Whitehead. "The Scientific Study of the Industrial Worker." *Harvard Business Review*. July, 1934. Pp. 458-471. Also Elton Mayo. *The Human Problems of Industrial Civilization*. New York: Macmillan Co. 1933.

²T. N. Whitehead. *Op. cit.* P. 462.

³T. N. Whitehead. *Op. cit.* P. 469.

Secondly, these changes of mental attitude usually, though not always, relate themselves to the workers' human relationships, either as between themselves, or as between the workers and the management.

And this suggests a rather obvious, but very important, truth; namely, where operators are working well within their physiological possibilities, their work behavior will be conditioned by their work morale. That is, their behavior will depend on the force and the liveliness with which the work situation captures their imagination, and tones their thoughts.

I have tried to show you that the element of human relationship is a very large part of the work situation to the worker himself.

The results of this investigation emphasize to the manager that the social and psychological factors are very important or more important than the physical factors affecting industrial production work. However, the wise manager will use both the physical and psychological factors to improve production.

MEDICAL AND HEALTH SERVICE

Human efficiency is dependent upon good health. Wise management will endeavor to maintain a healthy working force both in body and mind. Health and medical activities in industry attempt not only to prevent unhealthy workers from entering a company, but also to keep all workers healthy while they are working by the prevention of illness within the plant. Industrial health activities involve (1) physical examination prior to employment, and periodically, (2) first aid and dispensation, (3) medical treatment of illness and prevention of contagious disease, (5) hospital service, (6) sanitation, (7) special treatments, (8) health education, and (9) mental hygiene.

In order to prevent contagious diseases from entering the plant and to guarantee healthy entering workers, a physical examination usually is and should be given before the applicant is hired. Otherwise someone might be employed who had a contagious disease or some physical defect which would prevent him from doing his work efficiently. As a result of physical examinations, prospective employees are sometimes rated by classifications, such as "A" qualified for any work, "B" qualified for limited work, "C" qualified for work after the correction of certain minor difficulties, and "D" disqualified for work. A candidate for employment who rated "D" would not be hired. Physical examinations at the time of employment are given in about three-fourths of the companies in the United States. In order to discover health irregularities in employed workers before real

difficulties occur, some companies give physical examinations periodically so as to keep the worker in a healthy condition. This is not only for his personal happiness, but also for more effective work.

Often while a man is working he receives certain minor cuts and injuries, which if allowed to go without care until he reaches home may become infected and cause greater difficulty than if attention were given immediately. Many companies have provided first aid and dispensaries to care for these minor injuries and illnesses. Some companies even provide hospitals, special clinics, plant nursing, home and visiting nursing, and they make regular inspections of the plant for cleanliness and sanitation purposes. Small plants sometimes have local doctors visit them at stated hours to take care of health difficulties, or join with other small companies to provide medical activities. Industrial medical service is sometimes given as an example of socialized medical practice at reduced cost to the workers and their families.

The United States Public Health Service considers the following essential to a good industrial health and plant sanitation program:

1. Adequate lighting, with the light distributed properly, free from glare, and yet sufficiently concentrated on the work in hand to prevent eye-strain.
2. An exhaust system to remove deleterious fumes and dust.
3. Abundant drinking water, cold, but not ice-cold, within easy reach of the worker.
4. Attractive, quiet rest rooms, especially for women.
5. Lunch rooms or canteens where a hot lunch of nourishing, well-cooked food, selected according to a scientific dietary, may be purchased at cost price and eaten amid attractive surroundings.
6. Clean and modern, well-ventilated toilets.
7. Washing facilities, with abundant soap, clean towels, and shower baths where the hot, sweaty, begrimed worker may become cool and clean before leaving the plant.
8. Introduction of variety into work.
9. Introduction of recess periods.
10. Adjustment of speed.
11. Omission of unnecessary motions.
12. Provision for adjustable seats.
13. Ample ventilation of workrooms.
14. Adjustment of hours of work.
15. Avoidance of overtime work.
16. Omission of Sunday work.
17. Sanitary conditions outside the plant.

Dr. L. D. Bristol, Health Director of the American Telephone and Telegraph Company, has devised the following appraisal form for industrial health service in smaller industries and business concerns:

SECTIONS AND SUBDIVISIONS	ASSIGNED VALUES
A. Death, sickness, and accident records.....	15
1. Records kept.....	5
2. Records used.....	10
B. Sickness and accident prevention measures.....	30
3. Investigation of cases.....	7
4. Sanitary inspections.....	7
5. Sanitary supervision.....	6
6. Specific immunizations.....	3
7. Safety devices.....	5
8. Examinations after sickness.....	2
C. Personal health promotion.....	40
9. Physical examinations.....	10
10. Periodic examinations.....	5
11. Correction of defects.....	2
12. Health supervision.....	3
13. Supervision of occupational injuries.....	5
14. Medical attention.....	5
15. Health education.....	10
D. Public relations.....	15
16. Compliance with board of health regulations.....	5
17. Compliance with federal and state laws.....	10
Maximum total score.....	100

The purpose of all these health activities is naturally to make employees more healthy and efficient, not only for their personal enjoyment but also for the work of the company. Specifically, it may be to reduce absences because of sickness. When the usual absence from work because of illness is generally about seven days we can appreciate its importance in a company of 1,000 employees. If by health activities that absence because of illness can be reduced to four or five, it represents a saving to the company of two or three days per employee per year.

As specific examples, the Chesapeake and Potomac Telephone Company had a loss of 1,020 days per month per 1,000 employees before medical supervision was provided. After a medical system had been effective for some years the sickness rate dropped to 331 days per 1,000, or a saving of 700 days per

month per 1,000 employees.¹ The Standard Oil Company of New Jersey spent \$227,628 for their medical services which resulted in \$320,736 worth of treatment for injuries—a profit of 41 per cent on this activity per employee.² The fact that health work pays the company is an excellent reason for it, of course, in addition to the humanitarian reasons.

For an average industrial plant of 1,000, Dr. A. W. Schoenleber, Medical Director of the Standard Oil Company of New Jersey, recommends the following medical activities:

1. *Physical examination of applicants for employment.* Physical standards for rejection and for the various job assignments should be adopted. The percentage of rejections will vary with the needs of the industry and the general health of the locality. In our experience, rejections average about 10% and about 40% have defects which require correction before applicants can be accepted for general work or who may require assignment to special jobs.

2. *Treatment of injuries.* Minor injuries should be treated at the plant. More serious injuries should be placed in local hospitals under the best surgeons available, if the company has any choice in the matter. The company doctors should keep in touch with such cases. This activity should be carried out by a physician or supervised by him.

3. *Treatment of minor illness and medical advice.* This activity is a most valuable measure in preventive medicine. Encouraging employees to call on the plant physician whenever they feel below par facilitates the early diagnosis of infectious diseases, uncovers many early symptoms of general disease, faulty hygiene or detrimental working conditions. The actual treatment of minor illness is incidental but it is of value in keeping many on the job who would otherwise lose time.

4. *Periodic health examinations and surveys.* A routine physical examination and a recording of physical findings as practiced by some industries is a waste of time. Physical findings alone will uncover only a small percentage of the conditions which may have a deleterious effect on employees' health and efficiency. The employee's medical history, symptoms, habits, personal hygiene, mental and physical adjustments must be investigated. Having made a detailed study of the employee, the next step is the application of such corrective measures as may be indicated. The ability of a doctor to make the best practical use of his findings for the purpose of improving health is the real measure of his efficiency as an industrial physician.

5. *Special examinations of those exposed to industrial disease hazards.* The medical, safety and technical departments should coöperate in outlining safe working conditions for those exposed to industrial disease hazards. The medical department should make frequent examinations for the purpose of detecting early signs or symptoms of conditions which might result from exposure to dangerous chemicals, gases, or dusts. Prompt action as indicated by the findings will prevent the development of serious occupational diseases.

¹ A. W. Schoenleber. "How Industrial Medicine Aids in Management." *Personnel Journal*. Vol. 14, Nos. 7 and 8. January and February, 1936. P. 297.

² A. W. Schoenleber, *op. cit.*

6. *Sanitation and health education.* The medical department should be responsible for advising the management on all matters pertaining to plant, office, or camp sanitation. The importance of this activity will vary with the industry. If operating in isolated localities in the tropics or Southern United States where certain diseases are endemic it may be the major medical activity. Health education by means of articles in plant publications, by pamphlets, posters, etc., is also a very valuable procedure.

7. *Keeping medical records.* This is an important function which will protect the company from unjust claims, be of value to the employee as an accurate medical history, and provide data for statistical studies which will indicate conditions requiring special attention.

8. *Coöperation.* There are many activities which require the coöperation of the personnel, safety and medical departments. Problems relating to fatigue, mental up-set, etc., are of primary interest to the personnel department. However, if a medical department functions efficiently, especially in its health activities, it can do much to minimize such conditions.

Summary. We can summarize our comments as follows: Industrial medicine is still in its infancy; it has made rapid strides during its short life and the future holds possibilities for great advances. In order to derive the best results from medicine both industry and the medical profession must make some adjustments. The problems for industry and those interested in industrial relations are: first, an extension of plant medical service to include companies which now fail to make such provisions for their employees; second, raising the standard of medical service in those industries which do not meet the minimum requirements; third, raising the status of a medical department within a company organization. The problems for the medical profession are: first, to provide adequate facilities for the training of physicians who wish to enter industrial medicine; second, intensive research and investigation in those branches of medicine which may be of value to industry.¹

SAFETY AND ACCIDENT PREVENTION

It has been estimated² that 98 per cent of industrial accidents can be prevented by correcting the following physical and supervisory accident causes:

SUPERVISORY	PHYSICAL
Faulty instruction	Physical hazards
Inability of employee	Poor housekeeping
Poor discipline	Defective equipment
Lack of concentration	Unsafe building conditions
Unsafe practice	Improper working conditions
Mentally unfit	Improper planning
Physically unfit	Improper dress or apparel

Industry has given us many comforts, luxuries, and conven-

¹ A. W. Shoenleber. "How Industrial Medicine Aids in Management." *Personnel Journal*. Vol. 14. Nos. 7 and 8. January and February, 1936. Pp. 301-2.

² H. W. Heinrich. *The Origin of Accidents*. Hartford, Conn.: Travelers Insurance Co. 1928. P. 6.

iences—railroads, automobiles, airplanes. Yet these creations are not entirely beneficial because they contribute to the accidental deaths of between 70,000 and 90,000 people and over 3,000,000 injuries each year. Besides this human waste, Heinrich¹ has estimated that the average cost to industry, worker and manager, is about \$246 per injury at a total cost to this country of several billion dollars. This human and financial loss is outrageous when we consider that most of it could be prevented if there was a sufficiently strong desire on the part of the people to do so. In industry alone between 20,000 and 30,000 workers are accidentally killed each year.

The principal factors which are used to prevent accidents are as follows: (1) mechanical safeguards; (2) safety education and publicity; (3) safety inspections, safety records, and statistical work; (4) engineering revision and safety engineering; (5) safety competitions, rallies, and parades; (6) fire and police activities. One of these methods alone may do but little good, but all of them can decrease accidents materially. For example, the Eastman Kodak Company decreased accidents 90 per cent; the Illinois Steel Company, 70 per cent; the Bucyrus Company, 65 per cent, and so on, showing that accidents can be decreased by these means.

It has been estimated that mechanical safeguards, mechanical guards placed upon the machine so that the worker cannot injure himself, can prevent only about 10 per cent of the accidents that occur in industry. The psychological and physical factors in accident prevention are extremely important. Nevertheless, every machine should be mechanically safe to the extent of *positive* safety if possible. Positive safety means that a machine is positively safe so that the worker cannot operate it unless he is free from injury. For example, in operating a punch press the worker's hands must be up and away from the dangerous parts grasping the starting levers in order to operate the machine. Positive safety can usually be accomplished, then, by so placing the starting levers that the worker's hands or other parts of his body are safe before he can start the machine. This may decrease production on the machine, but one of the jobs of the manager or his engineer is to make machines positively safe without decreasing production.

¹ H. W. Heinrich. "Industrial Accidents and Safety." *Monthly Labor Review*, November, 1930.

Probably the greatest number of accidents can be prevented by safety education, publicity, and the other safety activities. It has been estimated that 90 per cent of the preventable accidents can be prevented by these means. They involve appointing of safety committees; holding safety conferences and discussions, exhibiting of safety posters, having regular periodical safety inspection, preparing safety statistics about accidents and publicizing them, holding safety competitions between departments and plants, safeguarding the plant from the standpoint of fire, protecting the plant by police activities, and engineering revision and safety engineering.

In practically all states it is necessary to prevent accidents because the employer is legally liable for accidents in his plant. Under the Workmen's Compensation Acts the employee is compensated for accidents arising during his employment. This usually involves the reimbursement of one-half to two-thirds of the weekly salary with a stated maximum and minimum amount payable. In case of death, a fixed sum is paid to dependents by the employer. For the loss of a finger, arm, or other member of the body there is usually a fixed sum paid. For total disability there may be a lump sum, or payment of a percentage of the worker's wages periodically. Many companies cover their accidents and liabilities through compensation insurance with established insurance companies. The premiums are calculated actuarially and based partly upon the number of accidents which occur. The lower the number of accidents, the lower will be the premiums. Therefore, in addition to the predominant human motive of saving life and preventing suffering there is an actual financial advantage to be gained by preventing accidents.

PERSONNEL SERVICE WORK

Personnel service work originally took the form of welfare work, but the old welfare work became so paternalistic and charitable that even the employees objected to it in one company to the extent that they called it "hellfare" work. In recent years it has developed into a more strictly business proposition and has taken over many of the extra financial benefits to employees which are often organized, managed, and supported by the employees and management cooperatively.

Personnel service work usually includes the following activities:

Mutual benefit association.	Credit union.
Unemployment insurance.	Stock ownership.
Pensions.	Suggestion system.
Group life insurance.	Other welfare activities.

In the mutual benefit associations, employee members pay small fees each week or month which are usually added to by the employer and the resulting funds are used to pay accident, sick, and death benefits to the members. These associations are usually managed by a committee of employees with some assistance from the management.

During the depression beginning in 1929, unemployment insurance plans and pensions have received considerable attention. The Social Security Act passed by Congress in 1935 has emphasized this phase of personnel service work. Everyone is interested in what will happen if he should lose his job, or if he becomes too old to work.

In December, 1932, the United States Bureau of Labor Statistics¹ reported 14 company unemployment insurance plans in operation, two of which had been established in 1932. Four companies had discontinued the operation of their plans in 1932, three of which had been definitely discontinued. The fund of another company was practically exhausted. Two joint agreements and three trade union plans had been set up in 1932 and three joint agreements and four union plans had been discontinued.

Companies operating unemployment benefit plans in 1932 were as follows:

- Dennison Manufacturing Co., Farmingham, Mass. (1916).
- The Columbia Conserve Co., Indianapolis, Ind. (1917).
- Dutchess Bleachery (Inc.) Wappingers Falls, N. Y. (1919).
- Crocker-McElwain Co. and Chemical Paper Manufacturing, Holyoke, Mass.
- John A. Manning Paper Co., Troy, N. Y.
- Behr-Manning Corporation.
- S. C. Johnson and Son, Racine, Wis.
- Procter and Gamble Co., Cincinnati, Ohio.
- Consolidated Water Power and Paper Co., Wisconsin Rapids, Wis.

¹ U. S. Bureau of Labor Statistics, "Operation of Unemployment-Benefit Plans in the United States." *Monthly Labor Review*. Washington, D. C. Vol. 35. No. 6. December, 1932. P. 1225. Also *Monthly Labor Review* for June, July, August, and September, 1934, for the operation of unemployment insurance systems in the United States and foreign countries; and U. S. Bureau of Labor Statistics Bulletin 544: Unemployment Benefits in the United States and Unemployment Insurance in Foreign Countries Washington, 1931.

The Samarkand Co., San Francisco, Calif.

The General Electric Co.

J. I. Case Co., Racine, Wis.

Minnesota Mining and Manufacturing Co., St. Paul, Minn.

Besides the individual company plans there were developed several joint company plans¹ such as those at Rochester, New York, and Fond du Lac, Wisconsin. On June 3, 1932, the National Electric Manufacturers' Association, composed of 300 companies, announced the adoption of an unemployment insurance plan.² Industrial concerns in Wisconsin are covered by the State Unemployment Insurance Law,³ given in Appendix D. New York, Utah, and Washington also have state unemployment insurance laws.³ In general, the managements of but relatively few companies had adopted such systems before the Social Security Act and the state unemployment insurance laws went into effect.

In 1931, the United States Senate appointed a committee to investigate the subject of unemployment insurance systems in the United States and foreign countries. The committee, composed of the Hon. Felix Hebert, Hon. Otis F. Glenn, and Hon. Robert F. Wagner, held numerous hearings and reported⁴ to the Senate that any system of federal unemployment insurance was inadvisable at that time. A minority report by Senator Wagner favored, among other things, the encouragement by the federal government of state action by the establishment of a nation-wide employment service (which was carried out in 1933) by allowing employers to deduct from income tax a portion of their payments into unemployment reserves or unemployment insurance.

This resulted in the Social Security Act, passed by Congress in 1935.⁵ The principal features of this act were old-age assistance, old-age annuities, unemployment compensation, assistance

¹ U. S. Bureau of Labor Statistics. *Op. cit.* Pp. 1239-40.

² For the text of this plan see the *Monthly Labor Review*, Washington, D. C., Vol. 35, No. 1, July, 1932, p. 22.

³ For a summary of text of these laws see the *Monthly Labor Review*, Washington, D. C., Vol. 40, No. 5, May, 1935, p. 1195, etc., given in Appendix D. Also Vol. 36, No. 1, January, 1933, for Wisconsin law. The New York Unemployment Insurance Law was held constitutional by the United States Supreme Court on November 23, 1936.

⁴ For a summary of this report see the *Monthly Labor Review*, Washington, D. C., Vol. 35, No. 2, August, 1932, p. 268.

⁵ Seventy-fourth Congress, First Session. H. R. 7260. Union Calendar Number 186. This is also described in the *Monthly Labor Review*, Vol. 41, No. 3, September, 1935, pp. 570 et seq.

to needy dependent children, grants to states for maternal and child health services, the vocational rehabilitation of the physically disabled, public health services, and assistance to needy individuals who are permanently blind. The Social Security Act was declared constitutional in May, 1937 by the Supreme Court of the United States.

Industrial management is principally concerned with the old-age annuities and the unemployment compensation. A description of these two features is contained in Appendix C, a letter from the president of the Duncan Electric Company (Lafayette, Indiana) describing them to his employees. This letter gives the conditions of the Social Security Act and the Indiana State Unemployment Compensation Act¹ in which the management and employees of a company are principally concerned.

Closely related to unemployment insurance is dismissal compensation. The Industrial Relations Section of Princeton University made a study² of dismissal compensation plans in 80 companies of 27 cities by personal visits from a representative of the Section. More than half of the companies instituted their plans in 1931 and 1932, and almost all of them since 1929. The Section reported that the plans were subject to less curtailment than other industrial relations activities.

In 60 companies, 35 paid lump-sum dismissal compensation, 13 paid periodic instalments, and 12 paid by means of combinations of these two.

In 40 companies, 29 charged the dismissal wage to wages, production, other costs of the departments or units, 9 to special dismissal accounts or funds, 1 to the hiring office, and 1 to general expense.

The field of dismissal compensation is an activity which is distinctive of the depression beginning in 1929, and shows a change in attitude of employers, namely, to keep employees as long as possible, and when it is necessary to let them go to provide in some way for them to bear the burden of unemployment.

It is the belief of some employers that an employee provided

¹ The detailed conditions of the Social Security Act may vary with the conditions of each state's unemployment insurance act. However, all state unemployment insurance laws must meet the requirements of the Social Security Act and may be considered uniform to that extent.

² Princeton University, Industrial Relations Section. *Dismissal Compensation Plans in 80 Companies*. Princeton. 1932. As reported in the *Monthly Labor Review*, Vol. 37, No. 3, March, 1933, pp. 496-7.

with security for his old age (after he has given his best years to the company) is a more efficient worker while he is on the job. This belief coupled with the desire to provide humanely for aged employees in a business-like manner has led to the establishment of pension plans in industry.

The Industrial Relations Counselors¹ made a study of industrial pension plans during the period from July 1, 1929, to April 3, 1932. Sixty-nine industrial pension plans (4 non-contributory, 62 contributory, and 3 composites), were established during that period. The trend was found to be from non-contributory toward contributory plans, 12 companies with non-contributory plans having changed over to contributory ones.

Forty-five pension systems (28 non-contributory, 17 contributory), were discontinued or suspended during the period. Both establishment and discontinuance of pension plans were large during the period, but less were discontinued than established, so there was a net gain in the number of plans.

The 434 companies reporting on their pension systems were estimated as having built up \$625,000,000 reserves. All the 69 companies with new plans guaranteed the pension as soon as it was granted, and in 68 the guarantees are made by insurance companies.

Employees, it was reported, will support pension plans more wholeheartedly if deposits are returned with interest in case of withdrawal, if the pensions are guaranteed, and if a stipulation is made that funds paid in shall not in any event revert back to the employer. Employees also favor a benefit for total or permanent disability, a gradation of contributions according to age at entry, and a provision for optional annuity forms at retirement. Though these considerations are important, the Social Security Act now serves as a basis for industrial pensions.²

In the last two decades and even during the depression beginning in 1929 another kind of insurance—group insurance—has grown rapidly. In this plan the employees of the company, as a group, take out life insurance. The company deducts the premiums from their pay, and sometimes the company itself pays

¹ M. W. Latimer. *Industrial Pension Systems in the United States and Canada*. New York: Industrial Relations Counselors, Inc. 1932. As reported in the *Monthly Labor Review*, Washington, D. C., Vol. 36, No. 5, May, 1933.

² For the pension conditions of this act see the letter to the employees of the Duncan Electric Company in Appendix C.

the whole or part of the premium. By the group method, the insurance premium is much lower than the regular individual rate. All the employees are covered without physical examination at the time the insurance is taken out, but 75 per cent of the employees must participate. The old employees, as well as the young, are covered. This gives those employees who would normally not be able to obtain insurance commercially an opportunity to be protected.

Group insurance was investigated by Mr. W. J. Graham,¹ Vice-President of the Equitable Assurance Society of the United States, in 1932. Group insurance as first planned and sold was exclusively life insurance. In 1926, only 1 per cent of the premiums paid was for coverages other than life. In 1932, the eight leading group-writing companies in the United States reported that group insurance premiums were slightly over \$150,000,000 in 1931, of which one-third was for group accident and health, group accidental death and dismemberment insurance, and group annuities.

Although, theoretically, group insurance is directly influenced by conditions relating to employment, it is a matter of fact that in 1931 when the numbers employed and the wages were greatly reduced from the peak period reached during the preceding few years, every form of group insurance had maintained and increased its premium income. . . . Because of the fact that under the system of staggered employment (spreading work), a large number are retained on the payroll, even at reduced wages, it is possible to continue the insurance at the full face amount.¹

The amount of group life insurance in force in 1926 was \$5,425,987,646, and in 1931 approximately \$10,000,000,000, an increase of about 84 per cent in amount, and 171 per cent in the number of employers taking this form of protection. The number of employees covered in 1931 was more than 6,500,000, an increase of about 2,000,000 since 1926. The insurance per employee averaged \$1,200 in 1926 and \$1,540 in 1931.

About 20 group annuity contracts were in force in 1926, whereas in 1931 there were more than 200. In the past, premiums were practically all paid for by the employer alone, but almost all the newer plans are on a contributory basis.

If an employee becomes sick or has some other difficulty which

¹W. J. Graham. "Group Insurance." *Annals of the American Academy of Political and Social Science*. May, 1932. (As reported in the *Monthly Labor Review*, Vol. 35, No. 1, July, 1932, p. 53.)

makes it necessary for him to have a loan and he has no insurance against sickness nor money saved, he may have to go to the money lenders and pay a high rate of interest if the company does not have a loan plan for employees.

Many companies have credit unions which have enjoyed a healthy existence even during the depression of 1930, etc. A credit union is a cooperative association organized under a state or the federal credit union law within a specific group of people for the purpose of supplying the members of that group with a plan of systematic saving and of taking care of their own credit or borrowing problems at a legitimate rate.¹ The members of the group operate and control the credit union themselves.

The United States Bureau of Labor Statistics² investigated the status of credit unions in 1932. The report covered 1,472 credit unions or 91 per cent of such societies in operation in 42 states. The number of societies increased from 974 in 1929 to 1,612 in 1932, an increase of 65 per cent. Table IX gives the details concerning membership, capital, guaranty funds, and loans.

TABLE IX
COMPARATIVE DEVELOPMENT OF CREDIT UNIONS, 1929 AND 1932*

Item	1929	1932
Total number of societies.....	974	1,612
Number reported for.....	834	1,472
Membership:		
Total.....	264,908	301,119
Average per society.....	320	216
Share capital:		
Amount.....	\$24,065,407	\$21,708,328
Average per member.....	92	70
Guaranty fund.....	\$ 2,079,450	\$ 2,110,815
Loans during year:		
Total.....	\$24,548,353	\$16,375,952
Average per society.....	58,310	16,475
Average per loan.....	350	156
Loans outstanding at end of year.....	\$30,811,582	\$24,826,291

* U. S. Bureau of Labor Statistics. *Monthly Labor Review*. Washington, D. C. Vol. 37. No. 4. October, 1933. P. 774.

¹ For a discussion of credit unions and their recent developments, see R. C. Bergengren, *CUNA Emerges*, Madison, Wisconsin: Credit Union National Association, 1935.

² U. S. Bureau of Labor Statistics. "Credit Unions in 1932." *Monthly Labor Review*. Washington, D. C. Vol. 37. No. 4, October, 1933. Pp. 771-5.

The number of borrowers reported by 1,345 societies was 161,941, and 990 societies declared \$547,001 dividends ranging from 0.02 to 14 per cent. Massachusetts made the largest number of loans, and more than 50,000 persons were aided. Loss or possible loss, reported by 23 societies and amounting to \$2,907, was considered very small.

General examples of credit union laws are the United States Credit Union law, and that of the District of Columbia.¹

In apposition to group insurance, credit unions, and the other personnel activities which increased during the depression are those which had difficulty. Employee stock ownership plans, whereby the employees are permitted to purchase the stock of the company, probably had the greatest difficulty.

The Industrial Relations Section² of Princeton University investigated the effect of the depression upon employee stock ownership in 50 selected companies. The general conclusion drawn was that few employee stock purchase plans have been successful. Of the 50 plans studied, 31 had been given up or suspended at the time the study was made. This was due, in a large extent, to the falling prices of the securities sold to the employees and the reduction in employee incomes.

The median July stock market quotation of 35 stocks sold to employees by 31 companies showed an average of 98 $\frac{7}{8}$ in 1926, 115 in 1929, 72 in 1931, and 14 $\frac{7}{8}$ in 1932 (84 per cent below the 1926 median). The narrow margin of savings possessed by the majority of employees was considered the principal reason for the lack of desire to secure any effective control of their respective companies. "Employers were sincere in believing that stock ownership plans offered a desirable means for employees to save."³

Thirty of the 50 plans provided for a cancellation of the subscription upon the request of the employee. Other measures taken to protect the employees were the suspension of payments for stock in layoff or part-time work, loans to employees on

¹ For an analysis of the Credit Union Act of District of Columbia, see the *Monthly Labor Review*, Bureau of Labor Statistics, Washington, D. C., Vol. 35, No. 2, August, 1932, p. 311.

² Princeton University, Industrial Relations Section. *Employee Stock Ownership and the Depression*. By Eleanor Davis. Princeton: 1933. As reported in the *Monthly Labor Review*, Vol. 37, No. 2, August, 1933, p. 279.

³ Princeton University. *Op. cit.* P. 280.

stock as collateral, and a guarantee of the return of the purchase price.

An important trend was found to be toward plans limited to selective groups of executive employees. Fifteen of the plans were limited to higher-paid or executive groups, and eight of these were established fairly recently.

The study concluded that "much stricter limitations will be placed on the sale of company stock to the rank and file of employees."¹

It has usually been found that employee management of personnel service activities provides for a better cooperation and participation in those activities by the employees, the greater number of employees participating the better.

Many companies have established suggestion systems; the company provides suggestion boxes throughout the plant and maintains posters asking for suggestions on the improvement on any phase of the work of the company. Financial reward is given for suggestions in which savings are made. Ten per cent of the savings made by the suggestions is often paid. Other companies pay a definite sum decided upon by the suggestions committee. A committee of employees and the management usually manage the suggestion system. The operation of such a system depends greatly upon constant and prompt attention to the suggestions and the regular publicizing of the request for suggestions and cooperation. A good suggestion system will not run itself but must be given constant attention.²

Besides the service activities described above, many companies improve the morale and spirit of the employees through providing such activities as restaurants and cafeterias, company stores, cooperative purchasing plans, legal aid, savings plans, vacations with pay, company housing projects, profit-sharing provisions, and recreational activities.³

¹ Princeton University. *Op. cit.* P. 283.

² For description of suggestion systems see Z. C. Dickinson, *Suggestions from Employees*, Ann Arbor, Michigan: University of Michigan. Reprint from *Michigan Business Studies*, Vol. 1, No. 3, August, 1927. Also "Suggestion Systems," *Mechanical Engineering*, Vol. 56, No. 11, November, 1934, p. 671.

³ For description of these, see J. E. Walters, *Applied Personnel Administration*, New York: John Wiley & Sons, 1931. (Also other references at the end of this chapter.)

SPECIAL ASSIGNMENTS

1. Report on the personnel program of an industrial or business concern.
2. Report in detail on some personnel activities in an industrial concern, such as employment, employee representation, ratings, training program, safety, service work, a suggestion system, etc.
3. Report on personnel work in small companies. (Special reference: National Industrial Conference Board, *Industrial Relations Programs in Small Plants*, New York City, 1929.)
4. Apply the principles and methods of selection and employment to getting a good or better job for yourself.
5. Report on special methods which you or someone you know has found effective in handling people.
6. Report on the activities and organization of the National Safety Council.
7. Report on a selected *Safe Practices Bulletin* or bulletins of the National Safety Council.
8. Report on the Workmen's Compensation Act of your state.
9. Report in detail on the Unemployment Insurance Law of Wisconsin or New York.
10. Report, in detail, on the Social Security Act of 1935.
11. Report on "Work and Fatigue," by H. W. Haggard, *Mechanical Engineering*, Vol. 58, No. 5, May, 1936, pp. 298-301.
12. Report on *Getting Business Fundamentals and Facts to Workers*, New York: American Management Association, Personnel Series 18, 1935, 32 pp. (Also "Taking the Mystery out of Business," *Conference Board Service Letter*, April, 1935, p. 25.)
13. Report on *Research Studies in Employee Effectiveness and Industrial Relations*, Chicago, Western Electric Co., 1929, 23 pp.

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- (2) H. W. HEPNER. *Human Relations in Changing Industry*. New York: Prentice-Hall. 1934.
- (3) S. A. LEWISOHN. *The New Leadership in Industry*. New York: E. P. Dutton & Co. 1926.
- (4) ELTON MAYO. *The Human Problems of Industrial Civilization*. New York: Macmillan Co. 1933.
- (5) NATIONAL INDUSTRIAL CONFERENCE BOARD. *Industrial Relations: Administration of Policies and Programs*. New York. 1931.
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CHAPTER VI

MATERIALS, MACHINERY, AND MAINTENANCE

The management of materials and machinery has probably received more attention in the past than the management of men. At present the direction of human relationships seems to be increasing, though there still is and always will be the problem of the selection, control, and disposition of materials and machinery in modern industrial management. For example, in 1935 the General Motors Corporation spent \$15,000,000 on the improvement of their plants, especially machinery, materials, maintenance, and their management.

Losses which result from the poor management of materials can be discerned and determined more quickly than human waste. For most companies the cost of materials is greater than that of labor, and the management of those materials often assumes the greater portion of the executive's time.

Before any materials or machinery can be bought, used, and maintained there must be a plant in which to manufacture them. With a new product the first job of management is the location of the plant. After the plant is located it is necessary to lay it out in detail and construct it. When it is constructed the materials and machinery must be purchased. When purchased they must be handled—brought to the plant and moved to the place of manufacture or stored. Machinery and tools must be selected, installed, and made available for operations upon the material. The work places must be lighted, heated, and ventilated, and the machines furnished with sufficient power to operate. While the operation is being carried on, the management is concerned with the amount of waste as well as with the maintenance of the machinery and other material aspects of the company. In this continuum of procedure, the principal phases of the management of materials, maintenance, and machinery are as follows:

Plant location.

Purchasing.

Plant layout and construction.

Handling materials.

Stores.	Power, heating, and air conditioning.
Machinery and equipment.	Maintenance.
Lighting.	Waste.

PLANT LOCATION AND LAYOUT

The success or failure of a manufacturing establishment may be dependent upon the location of the plant. If the location is wrong the management will be greatly handicapped in meeting the competition of a company whose plant is located correctly, and vice versa. Management is aided when the plant is located where the product can be produced and distributed at the lowest possible cost. Some of the important factors governing plant location, classified under the various factors of management, are as follows:

With reference to money:

- The capital available for investment.
- Financial aid from the community.
- The value of land.
- Construction costs.
- Taxes.

With reference to men:

- The supply and value of labor.
- Accessibility of the plant to the workers.
- Favorable climatic conditions.
- Sanitary, fire, and police protection facilities.
- Housing facilities.

With reference to materials:

- The nearness to and availability of materials.
- Electric power, light, gas, and water supply.
- Buildings available.
- Facilities for the disposal of waste.
- Climatic conditions for the manufacture of the material.
- The character of the site.

With reference to marketing:

- Nearness to and accessibility of the markets.
- Transportation facilities.
- Dependence upon other industries.
- Relative values of local markets.

With reference to general management methods:

- The momentum of an early start.
- The initial building requirements.
- Possibilities for expansion.
- Community restrictions and aid.

The favorableness of industrial laws of the state—towards labor, sales tax, corporation tax, etc.

General taxes.

Not all these factors will enter into the consideration of the location of each plant, but it is good practice to make a detailed survey of all of them in considering each location. The value of each factor for the location of one plant may be entirely different from the value of the factor in locating another plant. In one location the supply of labor may be the most important, in another it may be the nearness to raw materials, whereas, in another, climatic conditions may be the governing factor. The following values were given to these factors in selecting the location of a Monel metal plant:¹

Labor	250
Fuel	330
Power	100
Living conditions	100
Transportation	50
Water supply	10
Climate	50
Supplies	60
Taxes and laws.....	20
Site (cost and quality).....	10
Construction cost	20
Total	1,000

Similarly, each plant must be evaluated by the management in order to determine the best possible location.

After the management has decided upon the section of the country, it then has the problem of determining whether the plant should be located in the city, in the country, or in a suburban district. Most plants are located in the cities or towns, because there is usually found the greatest congregation of men, money, materials, and machinery, and because of the better facilities for transportation existing in cities which are natural centers for railways, highways, and waterways. Likewise, they sometimes offer marketing advantages as well as operation facilities such as heat, light, power, and police and fire protection. Some of the disadvantages of an urban location are higher prices

¹ W. L. Witherspoon. *Selection of Monel Metal Plant*. Paper to A.S.M.E. December, 1922.

of property, higher living costs, higher taxes, and the various restrictions of city ordinances. The country offers cheaper land and often lower labor costs. For a large plant, however, the shortage of labor may be one of management's greatest difficulties in the country. The suburban locations sometimes offer a compromise, providing some of the advantages of both types of location. However, a detailed survey of the factors to be considered in plant location should answer the doubtful questions.

At present, the tendency in plant location seems to be toward specialized plants. For example, Henry Ford has built small highly specialized plants in the country where each employee's home is located on a plot of ground which he can till when work is slack during the summer. A radio corporation in a large city recently established a branch factory in a small city because of labor troubles in the large city combined with a low labor cost in the small one. This emphasizes the need for the evaluation of the various factors.

When the location of the plant has been determined by means of a survey, the company has the problem then of buying or leasing. If the company can find a building already constructed which would be adapted to the manufacture of its products at a low cost it may be more advantageous to lease it than to build its own plant. Leasing calls for the least fixed investment, capitalization, and loans, and allows the money which would otherwise be used for these purposes to be used for operation and promotional problems. Depreciation, taxes, and other such fixed charges are reduced. However, the fixed expense in rent is higher. Oftentimes a company has manufacturing requirements which it can satisfy only by constructing and owning its own plant. Also, a company may be able to build its own special type of plant, the operation expense of which would be much lower than the operation expense in a building which has been built for another purpose.

In case of buying or leasing, the company must consider the type of building—a single-story or multistory type.

The Austin Company, engineers and builders of Cleveland, have made the following comparisons between multistory buildings and single-story buildings having the same gross floor areas:

TABLE X

COMPARISONS BETWEEN MULTISTORY BUILDINGS AND SINGLE-STORY BUILDINGS HAVING THE SAME GROSS FLOOR AREAS*

Multistory building		Single-story building	
72,000 sq. ft.	Total gross area	72,000 sq. ft.	
Area lost		Area lost	
2,976 sq. ft.	Columns	1,168 sq. ft.	
1,512 sq. ft.	Elevators	None	
2,160 sq. ft.	Stairs	None	
3,600 sq. ft.	Approaches	None	
3,120 sq. ft.	Outside walls	1,260 sq. ft.	
13,368 sq. ft.	Total area lost	2,428 sq. ft.	
58,632 sq. ft.	Total usable area	69,572 sq. ft.	
82%	Percentage of usable area	96%	
½ acre	Land required	2 acres	
\$164,000.00		Cost of building complete	
3,000.00		Cost of land at \$6,000 per acre	
\$167,000.00		Total price	
		Price per square foot of building, including heating, lighting, plumbing, and elevators	
2.27		1.70	
2.77		Price per usable square foot of building	
2.85		Price per usable square foot of land and building	

* The Austin Company. *Multistory or Single Story—Which?* Cleveland, Ohio. 1936.

If only the gross area of the building had been considered in these two buildings, the multistory building might have been selected, with less area and greater operating cost than the single-story building.

If a company builds and owns its own plant, there are, in general, three types of construction: mill, structural steel, and reinforced-concrete construction. The mill type of construction usually consists of brick or masonry walls and interior wood timbers. A wood floor is laid on wood girders. In the structural-steel type of construction, the structural part of the building is made of structural steel, especially the columns and roof support. A common type is the single-story building with a concrete floor, structural-steel columns and supports, with a saw-tooth, or half saw-tooth and half flat roof. In the reinforced type of con-

struction, the columns and flooring are made of concrete reinforced with steel. Some of this third type are made of flat slabs and others of beams and girders, both, of course, being made of reinforced concrete. Combinations of two or three of these types are found in many plants.

The type of construction of a plant may depend upon the locality. It may be cheaper to build a stone building in a locality where native stone can be obtained economically than to use a brick construction. A survey of building conditions should be made in the consideration of any type of construction, because the design of the building will depend upon the product to be manufactured, the purpose for which the building is to be used, the cost of construction and operation, the insurance, the depreciation costs, the equipment to be used, the time of work, such as day or night, and the other factors mentioned in this chapter. In recent years there has been a tendency to design a factory building around these factors, rather than just putting them into the building. One company has constructed a building almost completely ventilated and illuminated artificially in order to provide the best working conditions and operation layout. Another company laid out their manufacturing processes and then built their building around the equipment to perform those operations.

The ideal in plant layout and construction is to make factory buildings artistic as well as useful. Artistry and usefulness can be combined, because usually the more efficient a thing is, the more artistic it is. Often, however, the beauty of the architecture may make the cost higher than is practical from the standpoint of the investment. The Toledo Scales Company had a very artistic factory building designed, but found that the cost would be too great, so they redesigned it to provide more usefulness and less cost. However, the combination of art and usefulness should be investigated, at least, because the tendency, in recent years, has been to make factory buildings more artistic than formerly. This applies not only to exterior, but also to interior design. The author heard recently that a prominent automobile manufacturer had requested that certain of his production machinery be designed streamlined and more artistically before he would purchase them.

Sometimes the plant layout can be adapted to the conventional

types of building and construction at a lower cost than if a special type or types are developed.

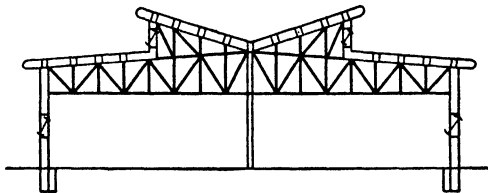
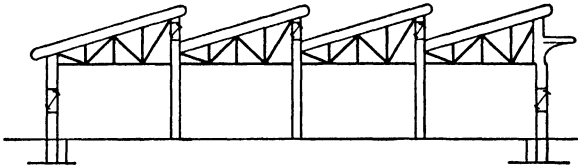
The conventional types of buildings are as follows:

LTUCHFEI

Most of these designs permit future extensions as shown by the dotted lines following:



In recent years there have also developed some conventional types of factory buildings for economy of construction and operation costs. Below are sketches of samples of conventional cross-sectional designs:



In contrast to these conventional types, the construction of a new building around the best plant layout may be ideal from the standpoint of operation, but usually the layout has to be developed and adapted to an old building already constructed. In either of these situations the best layout is the important consideration. The plant has the job of producing a product and the production of that product determines the layout. This involves the layout or the flow of processes and materials in the most economical manner from the standpoint of cost, time, and

effort. Where a large number of units of the same product is produced, it may be possible to lay out the work into a continuous process. The material is started at one end and progresses continually through the various processes and operations to the other end as a finished product. The various operations are placed in sequence in such a way that each consecutive operation is performed without delay.

When a limited number of units of each product is to be produced, the plant may have an intermittent layout, in which all the same kinds of machines or processes, such as grinding, turning, or milling operations, are congregated together, and the product is intermittently sent to each kind of machine or process to have that operation performed on it.

The type of layout involved will depend not only upon the nature of the manufacturing business and the product, but also to a great extent upon the amount and number of products to be produced. Also, if the raw material is made into several products, the layout would naturally have to be different than if several raw materials were made into one product. However, at present most plants strive for a continuous layout.

Plant layout usually involves the adaptation of a new layout to an old building or the revamping of the old layout so that it will be more economical to operate. A number of years ago it was always customary to lay out machines and equipment in straight lines with aisles between the rows and with space as production centers for each of the machines. Then conveyors were installed between the rows. Today the application of modern layout methods and time and motion study to the methods of production, handling material, and the flow of operations decreases the space required for equipment and the costs of production and handling material.

The sequence of making such a modern layout study is as follows: (1) make or obtain a time and motion study of each operation to find the best way of performing it; (2) make trial arrangements (in miniature) until the best possible arrangement is formed, so that the material is handled the least and the number of operations is the smallest; and (3) discuss the various plans with those concerned with their effectiveness, and improve the layout until it is the best from a practical viewpoint. In making the trial layouts, the following procedure has been found effective. Obtain a construction blueprint giving the building and departmental outlines to scale, showing the effective work-

ing spaces as well as the columns, stairways, doors, windows, etc. Mount the print showing both the available working and "dead" space on a piece of wall board; place the board on a table in such a manner that it can be worked on from all four sides.

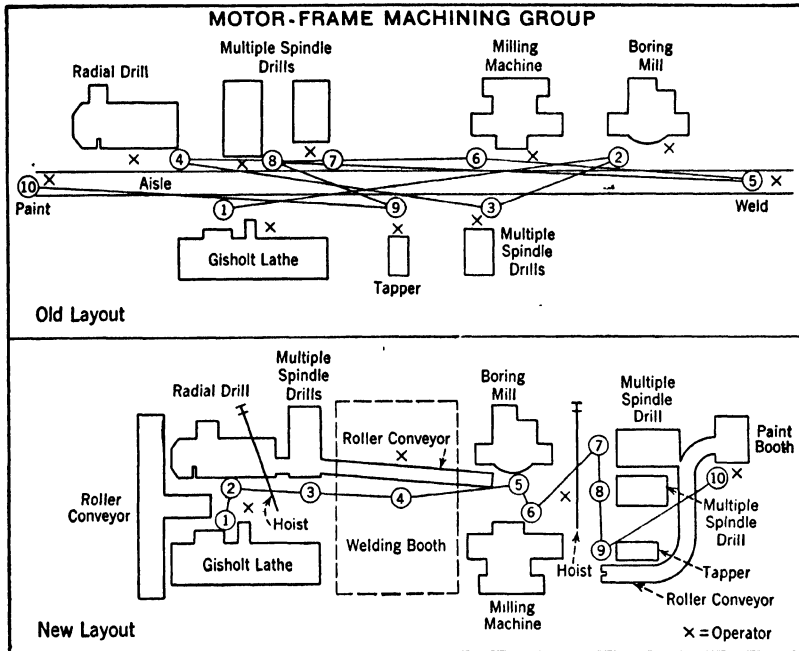


FIG. 44.—Motor-frame machining group layouts. (C. G. Johnson, "Plant Layout Cashes in on Motion Economy." Reprint by A. H. Mogensen, *Factory Management and Maintenance* on "Plant Layout." 1931-35. P. 17.)

Old Layout—Conventional straight-line layout where ten operators performed ten machining operations on motor frames. Note the back-tracking and the distance traveled between operations.

New Layout—Same machines, same operations, but laid out in accordance with motion analysis principles. No back-tracking here, and two and a half times as much production. Conveyors and jib cranes have cut out manual handling.

Make miniature templates of each machine and piece of equipment to be used in the layout. Use different colors to designate equipment already owned by the company and that which will have to be purchased. Cut the templates to the scale of the building blueprint, not only for the equipment itself, but also for any space that is needed for holding material, etc., such as the load rack for an automatic screw machine. Arrange the equipment

so that when one man finishes his operation upon the product he places it in such a way that the person performing the next operation has it ready to work upon, or prepositioned. Arrange the machines so that one operator can handle several machines where such is possible. Try many possible arrangements until the best is found. Pin the templates by means of map pins to the layout in the best arrangement, considering, of course, the type of equipment, how it is driven, and other operation factors. After the equipment templates have been pinned to the board in their proper place, tie a string on the first piece of equipment to be used and then, in turn, run the string to each piece of equipment in the order of the flow of work of that product. Where there are several products, different colored strings are often used for the different products. Follow through the flow of work on each product, each operation, and the various operations on each product, by means of strings to each piece or set of equipment according to its layout. When the strings for the product or products are in place, lost motion, back tracking, duplication, etc., are easily determined. Restudy, by means of the strings and templates, the flow of work, material handling, etc.; revise the layouts until the best layouts under the circumstances are developed. The result of such a procedure as just described is shown in Fig. 44, which gives both the old and new layouts for motor frame machining. (Also see the layouts in Chapter VII on manufacturing.)

PURCHASING

After a plant has been laid out, materials must be purchased before they can be manufactured. In recent years executives have endeavored to apply the scientific method to the purchasing of materials. Because purchasing has always been a highly personalized procedure, the application of this method has been slower than in some of the other fields of management. Purchasing was greatly diversified and difficult to systematize because each purchaser knew what *he* wanted to purchase. Earlier, products were not as complicated and did not require the exactness of present-day purchasing practice. Modern purchasing is exact buying based upon facts. In particular concerns, scientific purchasing has reduced the purchase price on special items as much as 50 per cent. The objects of scientific purchasing, then, may be stated as follows:

1. Decrease in purchasing price.
2. Procurement of materials which best suit the product and the purposes for which they are intended.
3. Use of scrap and defective products.
4. Reductions of inventories to the lowest and best balanced use.
5. Improvement of the product with reference to quality and merchandising by means of selection of adequate material.

Purchasing is the procurement by purchase of the proper materials, machinery, equipment, and supplies used in the manufacture of a product, adapted to marketing, in the proper quantity and quality at the proper time and at the lowest price consistent with the quality desired.

Effective purchasing may be carried out by the following steps:¹

1. The ascertainment of an accurate statement of character and amount of material or commodity needed, preferably based upon exact specifications.
2. The development of the desirable sources of supply and the negotiation with those sources by means of requests for bids.
3. Analysis of the proposals, the selection of the vendor, the awarding of the contract, and the placing of the order.
4. Follow-up of the order, routing the order, checking invoices, and the inspection of goods.
5. The maintenance of controlled inventories.
6. Completion of the records.

The first step in preparing an accurate statement of the character and amount of material needed usually starts in the production control department, which ascertains the production needs and prepares a list of material to cover them. The specifications for the material are usually prepared by the engineering department. Exact and correct specifications are very important because the quality of the material used influences the product not only through production but also in marketing. Good manufacturing procedures on poor material may result in a poor product of slight salable value just as easily as a good product may be ruined by poor manufacturing processes. Therefore, it is essential that the materials which are best adapted to the product at the marketing end of manufacturing be procured at the start.

The person in charge of purchasing should check all requis-

¹ Compiled from National Association of Purchasing Agents, *Purchasing; An Outline of Essentials and Methods*, New York, 1930, Chapter III, also H. T. Lewis, *Industrial Purchasing*, New York, Prentice-Hall, 1933, Chapter III.

tions and make certain that the material desired is correctly specified, and that the amounts are correctly given, so that the bidder knows exactly what is required. For example, in purchasing steel, its chemical content is specified in detail. In purchasing certain materials the exact method of manufacture is sometimes specified. The exact qualities and sizes are given specifically with their tolerances. Specifications may be indicated by such means as brand or trade name, blueprints, chemical analysis or physical characteristics, description of manufacture and use, or by sample. Oftentimes the blame for purchase of improper material can be traced back to an inadequate specification issued by the purchaser. If the specifications are unmistakably stated and understood by both the purchaser and the seller, purchasing difficulties are greatly reduced. In some cases, however, specified requirements might be met, for practical purposes, by standard materials generally manufactured which could be purchased at greatly reduced cost. A simplification of specifications should be made wherever possible.

After the need is ascertained and the specifications correctly stated and simplified, the next step is to locate the desirable sources of supply by means of (1) purchasing records, classified by products and suppliers, and subdivided according to price, quality, terms, shipments, etc., (2) catalogues, classified and cross-indexed by products, and any other division which may be needed for the purchase of the required material. Old sources of material supply may be adequate, but it is usually considered wise in purchasing to consider constantly the development of new sources. Past specifications may regulate the new sources which, nevertheless, should be investigated as to their ability to make and supply the material promptly and of the quality desired.

Only reliable sources of supply based upon investigation should be approached and requested to give quotations. After the quotations from the sources of material supply have been received, they are listed, and analyzed to determine the *right* price for the product. The right price is the *fair* or best (not necessarily the lowest) price for the product. When other factors, as well as price, such as the reputation of the supplier, the delivery record, and the quality of material, have been adequately considered, the details of each bid should be investigated minutely, placed side by side, and carefully compared. From the

detailed comparison and the general analysis of the various bids, the best price should be selected.

When the best price has been determined, the contract should be awarded if the buyer and seller understand precisely what is expected of each other by means of the simplest contract possible. Most contracts consist of a purchase order and its acceptance. The purchase order usually contains (1) serial number, (2) date of issue, (3) the name and address of the firm receiving the order, (4) quality and description of the material ordered, (5) date of delivery required, (6) shipping instructions, (7) prices, and (8) terms of payment. Where the order has been based upon detailed specifications, those specifications should be included or specifically referred to in the contract or purchase order. The United States Department of Commerce has recommended a national standard purchase order and inquiry form¹ as shown in Fig. 45.

When the purchase order has been placed or the contract awarded, the purchaser has the job of following up the order to see that it is properly placed, promptly filled, routed through the shortest or most economical route, and the delivery date maintained. When a purchase order is placed a sufficient number of copies are usually made so that, after sending the original to the supplier, two copies can be kept in the purchasing department, one sent to the stores department and one to the receiving department. The copy for the receiving department may omit the quantities ordered so that when the material is received the exact amounts and qualities are checked and accounted for correctly without reference to the amounts and qualities ordered. The amount received and the amount ordered are then checked by the purchaser, and the order is approved for payment if the two amounts agree in every detail.

When the material is received it may be placed in stores or sent to the place where it is to be worked upon. If it is placed in stores, the amounts are entered on a perpetual inventory (see Balance-of-Stores Record, Fig. 47), supervised by the purchasing or production department. These inventory records maintain the amounts of material in stores at all times with a minimum

¹ Simplified Practice Division of the Bureau of Standards of the United States Department of Commerce. "Commercial Forms." Washington, D. C.: Government Printing Office. 1928. Simplified Practice Recommendations of 37-38.

FIG. 45.—NATIONAL STANDARD PURCHASE ORDER AND INQUIRY FORM¹

Zone 2 For name, address, etc., of buyer Zone 3 For name and address of seller to whom purchase order is to be mailed Zone 4 For shipping instructions Zone 5 For general condition of purchase Zone 6 For listing materials ordered	Zone 1 For all necessary instructions of buyer and seller, in upper right-hand corner, convenient for reference in loose file or binder. (Includes order numbers, etc.)
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Standard Zone System for Purchase Order and Inquiry Forms

The zone system will to all intents and purposes serve as a standard purchase order or inquiry form, in that each item of information will always be found in a definite place. Relative sizes of zones may be varied to suit needs of user.

The upper part of Zones 1 and 2 may contain information not necessary for the seller but of value as a record for the buyer, and may be detachable by perforation on the original copy.

Orders and inquiries should be on sheets 8½ inches wide, and either 7, 11, or 14 inches long.

This standard was adopted at a National Conference at the Division of Simplified Practice, Department of Commerce, Washington, D. C., Jan. 14, 1925.

Zone 7

Signature of Buyer

expense and at the same time adequately serving production needs.

When the material is correctly received, the records can then be completed and the material paid for as soon as possible in order to take advantage of purchase discounts, which are a relatively easy source of profit. Most up-to-date managers take advantage of these discounts to decrease cost. Overlooked discounts

¹ Simplified Practice Division of the Bureau of Standards.

are an indication of poor management. When the material is paid for, the purchaser still has to follow up this purchase to see that it fulfills the purpose for which it was intended, and a record is made of his findings. This completes the purchasing procedure.

In general, then, some of the purchasing principles found effective are as follows:

1. Centralization of purchasing function to prevent overlapping of purchasing duties and to provide higher specialization and greater efficiency of this function. Coordination of purchasing with the other functions of the company.
2. Standardization of products and materials purchased, with reference to standards of measurement, constants, quality, performance, and practice.
3. Research on and testing of materials purchased, and the study of quality.
4. Constant study of prices, generally, and on specific products purchased, with reference to present and potential supply and demand, and the right time to buy.
5. Study of markets, and use of market statistics and market analysis.
6. Study of traffic.
7. Collection and classification of purchasing information and data, and the transfer of these data to those using them.
8. Development of adequate office procedure and purchasing forms, keeping the purchasing budget in line with the prices which were considered in making the budget.
9. Consideration of buying to make a profit.

From these principles it can be seen that procurement today can require a professional purchaser or buyer to obtain materials correctly for manufacturing. For such a purchaser, there have developed certain principles of "buymanship"¹ which the National Association of Purchasing Agents gives as follows:

Buymanship, as the "art of Buying" seems to reduce itself to five principles:

1. Good faith and fair dealing. Honesty is the best policy in business today simply because it pays in dollars and cents.
2. Knowledge of the field. This is the purchasing agent's sword as well as armor. He protects himself and gains his ends because he "knows" what is right rather than relying upon any cleverness, upon the possession of which he may pride himself.
3. Skill and tact. The purchasing agent must know men and understand how to deal with them. There is a finesse and technique here that he must master, if he would get close to men, understand their motives and impulses, and interpret their words and actions. The humanics of his job is an art that he can well afford to study.
4. A knowledge of values. The buyer must see in and around what he buys.

¹ National Association of Purchasing Agents. *Purchasing: An Outline of Essentials and Methods*. New York. 1930. P. 5, Chapter 8.

He must see it in relation with the need it is to meet, as a woman sees a piece of silk in the finished dress. As the average man cannot visualize the piece of goods as a beautiful dress, the man lacking a merchandising sense and scale of values cannot see the values in goods.

5. Perspective. Buyers must be long-sighted. Not today's price, but tomorrow's price, is what counts. In order to discount a market perspective a penetrating vision is necessary.

Though the purchaser uses these principles he must determine whether he should buy direct or through the middleman. If small quantities are to be purchased the middleman may furnish the best source of supply. The consideration of from whom the materials shall be purchased must be studied with reference to the amount, quality, and other factors of the purchase. The final decision in all these matters of purchasing rests upon the goal of the *right price* which includes a consideration of quality and the other purchasing factors.

MATERIALS HANDLING

Upon purchase, materials arrive at the factory from the railway car or truck, are transferred to the storeroom or directly to the job, are thence moved from job to job until they are finished, and are placed in stock or shipped to the customer. The handling of materials through this moving process represents a large cost—a greater part of the non-productive costs. These high handling costs are generally indicated where:¹

1. Unnecessary handling is performed.
2. More than one man is moving materials without mechanical assistance.
3. Men are lifting and handling articles weighing more than 100 pounds.
4. Men are loading from floor to trucks or from trucks to floor.
5. Machine operators are doing any laborious lifting or any work except putting articles into machine, supervising machinery operations, and removing articles when finished.
6. Materials are moved from container to container.
7. Materials are unnecessarily diverted from receiving platform for clerical records or inspection when they should go directly to machines.
8. Men on assembly floors or elsewhere are waiting for materials.
9. There are delays in delivering from storeroom to operators.
10. Scheduling for delivery is inadequate, causing delays at machines or necessitating extra delivery trips.
11. There is retrograde movement of materials in process of fabrication.
12. Antiquated apparatus or methods are in use.

¹L. P. Alford (Editor). *Cost and Production Handbook*. New York: Ronald Press Co. 1934. P. 852.

The reduction of these costs may be made by the application of certain principles which have been discovered. The first principle in handling materials is *not to handle them*, or to handle or move them the least possible amount. With the introduction of conveyors in recent years, some companies have been able to manufacture their products "on the move," that is, while the materials are being moved from place to place, or from job to job. Another principle is to make the materials-handling routine as automatic as possible, and in a direct line without regression and with as few transfers and delays as possible.

W. T. Spivey has given the following nine rules that apply to materials handling:¹

1. Know every kind of materials equipment on the market.
2. Analyze materials routing carefully.
3. Visualize each job's actual needs.
4. Buy for operating savings, not for first cost.
5. Get together with designers and manufacturers.
6. Lay out equipment when building is planned.
7. Rearrange equipment systematically.
8. Teach operator possibilities in his equipment.
9. Maintain equipment the same as production machinery.

Roe and Lytle² have given some general principles and methods of materials handling as follows:

1. Reduce all transportation to the lowest possible limits; therefore:
2. Reduce lines of travel, and wherever possible have the machines and operations in sequence. To do this:
3. Lay out a flow sheet of the various operations and route of material.
4. Avoid crossing streams of traffic and possible congestion.
5. Utilize gravity wherever possible.
6. Eliminate or reduce the human labor in the movement of material.
7. Avoid changing materials from one container to another or loading from the floor to trucks, and vice versa.
8. Coordinate the movement with production, to avoid waits for materials, or the piling up of materials at various points.
9. Make the handling equipment perform process work, if possible, during transportation, as, for instance, stirring or drying in a screw conveyor.
10. Provide flexibility, if possible, so that a breakdown of one piece of handling equipment will not shut down the plant.

In moving or handling materials, a first essential is to be familiar with all types of equipment. A good classification of

¹L. P. Alford. *Op. cit.* P. 853.

²J. W. Roe and C. W. Lytle. *Factory Equipment*. Scranton, Pennsylvania: International Textbook Co. 1935. P. 467.

materials-handling equipment has been made by S. J. Koshlin¹ and is given in Table XI.

TABLE XI

GENERAL CLASSIFICATION OF MATERIALS-HANDLING EQUIPMENT

- 0.00—Conveying and hoisting systems in general.
- 1.00—Cranes.
- 2.00—Special and auxiliary hoisting devices and accessories.
- 3.00—Elevators and conveyors.
- 4.00—Overhead transportation over definite lines of travel.
- 5.00—Ground-track transportation.
- 6.00—Trackless transportation.
- 7.00—Coal- and ash-handling systems in various industries.
- 8.00—Materials-handling systems in various industries.
- 9.00—Special materials-handling devices and accessories.

Cranes

- 1.00—Cranes, hand- and power-operated, in general.
- 1.10—Overhead traveling cranes.
- 1.20—Gantry or bridge cranes (stationary and traveling).
- 1.30—Jib and pillar cranes.
- 1.40—Locomotive cranes (normal gauge, caterpillar).
- 1.50—Derricks (stationary, portable, traveling, floating).
- 1.60—Wharf or cargo cranes.
- 1.70—Shipbuilding cranes.
- 1.80—Steelwork cranes.
- 1.90—Special cranes.

Hoists, accessories, and various special devices

- 2.00—Special and auxiliary hoisting devices and accessories.
- 2.10—Hoists (chain, pneumatic, and electric hoists).
- 2.20—Accessories (buckets, magnets, ropes, chains, etc.).
- 2.30—Hoisting engines (winches, hand- and power-operated).
- 2.40—Draglines (scrapers and excavators).
- 2.50—Power shovels and other excavating machines.
- 2.60—Portable loading and unloading devices.
- 2.70—Car-handling devices.
- 2.80—Ship-loading and unloading devices.
- 2.90—Skip hoists.

Elevators and conveyors

- 3.00—Elevators and conveyors in general, also accessories.
- 3.10—Elevators of platform type (fixed and portable).
- 3.20—Elevators for unit-loads (arm, tray, push-bar).
- 3.30—Elevators for bulk materials (bucket-elevator, elevator-conveyors).
- 3.40—Gravity conveyors (chutes and spirals, gravity-rollers).
- 3.50—Conveyors for unit-loads (push-bar, apron, chain, etc.).
- 3.60—Belt conveyors (flat and troughed) and accessories.
- 3.70—Other conveyors for bulk materials (screw, flight, pan).
- 3.80—Pneumatic conveyors for loose materials.
- 3.90—Special elevators and conveyors (pneumatic tubes, carrousel).

Overhead carriers

- 4.00—Overhead transportation over definite lines of travel.

¹S. J. Koshkin. *Modern Materials Handling*. New York: John Wiley & Sons. 1932. Pp. 7, 8, 9.

TABLE XI—Continued

- 4.10—Overhead trackage and accessories (tramrail system).
- 4.20—Hand-moved trolleys (monorail hoists).
- 4.30—Power-moved trolleys (telfer).
- 4.40—Aerial cableway.
- 4.50—Aerial wire-rope tramway.
- 4.60—Cable cranes and other applications.
- 4.70—Monorail conveyors.
- 4.80—Wire-lines.
- 4.90—Special overhead-conveying installations.

Rail carriers

- 5.00—Ground-track transportation in general and trackage.
- 5.10—Industrial railways.
- 5.20—Cable railways.
- 5.30—Automatic railways.
- 5.40—Industrial cars.
- 5.50—Locomotives, trolley.
- 5.60—Locomotives, storage battery.
- 5.70—Locomotives, gasoline.
- 5.80—Locomotives, steam.
- 5.90—Locomotives, special (compressed air, fireless, rack).

Trackless carriers

- 6.00—Trackless transportation in general.
- 6.10—Trailers.
- 6.20—Tractors, gasoline, industrial.
- 6.30—Tractors, storage battery, industrial.
- 6.40—Trucks, gasoline, industrial.
- 6.50—Trucks, storage battery, industrial.
- 6.60—Trucks for special purposes.
- 6.70—Trucks, hand.
- 6.80—Tiering machines or portable elevators.
- 6.90—Platforms, skids, containers, and other accessories.

Coal- and ash-handling equipment

- 7.00—Coal- and ash-handling systems and devices in general.
- 7.10—Coal storage plants, central.
- 7.20—Coal storage, reserve.
- 7.30—Coal yards.
- 7.40—Coal bins and bunkers.
- 7.50—Coal weighing devices.
- 7.60—Coal- and ash-handling for power stations, central.
- 7.70—Coal- and ash-handling for boiler houses, large.
- 7.80—Coal- and ash-handling for boiler houses, small and moderate.
- 7.90—Special coal- and ash-handling installations.

Materials-handling in various conditions

- 8.00 —Adaptation and coordination of materials-handling equipment.
- 8.10 —Handling materials in the plant yard.
- 8.20 —Handling materials in multistoried buildings.
- 8.30 —Materials handling in warehouses.
- 8.40 —Handling raw materials in the steel industry.
- 8.50 —Materials-handling in the foundry.
- 8.60 —Sand and gravel washing plants.
- 8.70 —Stone and lime handling.
- 8.80 —Materials handling in coal and ore mines.

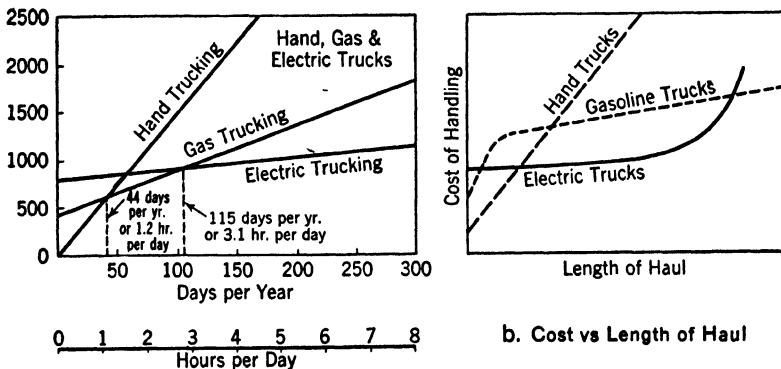
TABLE XI—Continued

- 8.90 —Use of standard types of materials-handling equipment in various industries.
 8.91-2—Use of cranes, hoists, accessories, and special devices.
 8.93 —Use of elevators and conveyors in various industries.
 8.94-6—Use of carriers, overhead, rail, trackless.

A survey of the progress in materials handling was made in 1929. The proportions of companies using the various types of materials-handling equipment were:¹

RANK		PER CENT	RANK		PER CENT
1.	Hand trucks.....	92	10.	Electric load trucks.....	13
2.	Hand lift trucks.....	40	11.	Electric low-lift trucks...	12
3.	Overhead cranes.....	37	12.	Electric tractors.....	12
4.	Monorails.....	30	13.	Tramrails.....	11
5.	Miscellaneous conveyors...	28	14.	Gas tractors.....	11
6.	Gravity conveyors.....	24	15.	Electric high-lift trucks....	7
7.	Belt conveyors.....	23	16.	Electric crane trucks.....	5
8.	Industrial railways.....	21	17.	Gas trucks.....	2
9.	Hand labor.....	19	18.	Gas lift trucks.....	1

Though the hand trucks may be used more than other type trucks, the cost of using the different kinds of equipment may



a. Operating Costs vs Hr. in Service

FIG. 46.—Operating costs of hand, gas, and electric trucking. (C. B. Crockett and H. J. Payne, Op. cit.)

vary according to the products manufactured. A sample of the results of a study² of the costs of different types of materials handling is given in Fig. 46a and b. For use a few hours per

¹ *Progress in Materials Handling. Trans. A.S.M.E.* Vol. 51. No. 3. MH-51-1. P. 5. January-April, 1929.

² C. B. Crockett and H. J. Payne. "Operating Costs of Electric Industrial Trucks and Tractors." *Trans. A.S.M.E.* Vol. 50, No. 5. MH-50-3. P. 5. January-April, 1928.

day and a small number of days per year, the hand trucking was less expensive than gasoline trucking and electric trucking. For short hauls a similar situation existed. For long hauls and greater use, electric trucks cost the least, gas trucks were more expensive, and hand trucks the most expensive.

Though these charts may represent costs in general, estimates should be made of costs for special plants and the special situations involved in handling materials before the equipment for handling those materials should be selected. The selection of the materials-handling equipment should be made in a similar manner to the selection of regular production machinery or equipment which will be described in a succeeding section of this chapter.

The results accomplished by the proper materials handling are increases in production, decreases in handling costs, and, in general, savings in handling materials. Examples of such savings in handling materials follow. The Nash Motor Company saved \$8,600 per year by installing standard conveyors for handling automobile cylinder blocks. The American Radiator Company saved \$22,000 per year in handling iron and steel by means of two tructractors. The Belden Manufacturing Company made a yearly profit of \$12,450 on an investment of \$19,611 from the installation of a complete conveyor system for handling their metal-working materials. Many other savings¹ from materials-handling installations can be found which show that proper materials handling pays.

STORES

When materials, tools, and supplies are received they are either sent to the place where they are to be used or they are stored. Certain management procedures have been developed in storing materials. Ideally, materials should be manufactured into finished products directly after they have been received. When they are stored without being used or worked upon, they are idle, and are considered by modern management as idle money. Therefore, one of the first principles in managing stores is that the smallest possible inventory should be maintained at all times, so that the stored material will not cause a loss on the investment in stores because it is not working. Modern management

¹L. P. Alford. *Op. cit.* P. 886.

keeps its materials constantly working at a high turnover rate for greater profits. However, these ideas of smallest possible inventory and largest turnover of materials may be antagonistic to that of having a sufficient amount of material available at all times to satisfy production needs. The manufacturing department must have materials available when it needs them. Therefore, the ideal of stores keeping would be to maintain the smallest possible inventory consistent with the needs of production. The same principle is involved with finished stock (finished material) as with stores the unworked material). The inventory of stock should be as low as possible, yet consistent with sales demand.

From the standpoint of stores and stock keeping, the materials involved are raw materials, supplies, tools, equipment, and finished stock.

When stores are drawn from the storeroom it should be considered the same as drawing money, because stores represent money, and a saving in stored materials represents a saving in money. If an employee should go to the treasurer of a company and ask for 50 cents without a detailed accounting for it, and it were given to him, the management would immediately consider that something was wrong with that treasurer, inefficient to say the least. But if an employee goes to a storeroom and asks for 50 cents worth of materials or supplies, receives it, and uses it without an adequate accounting, a less stringent attitude is often taken towards that act because managers are usually more lax in handling materials and supplies than they are in handling money. However, the viewpoint of management toward strict accountability for materials and supplies is changing for the better because the waste of material results in a waste of money. The accounting for and management of materials and stores should be as highly efficient as the management and the accounting for money.

The purposes of good stores procedure are as follows:

1. To check receipts and issues.
2. To keep stores on hand so the investment in them will be a minimum, and the amounts will be adequate for production needs.
3. To issue the correct amounts of materials.
4. To keep a perpetual inventory and maintain adequate stores records.

These purposes are kept in view in order to predict production

[illegible]

FIG. 47.—Balance-of-stores record sheet. (Adapted from several balance-of-stores records; principally from D. S. Kimball, *Principles of Industrial Organization*. New York: McGraw-Hill Book Co. 1933. P. 463.)

Note: The entries are purposely separated somewhat vertically to enable the student to read the balance on any date more readily.

needs, maintain a small inventory, and keep turnovers of material at the highest number. In order to accomplish these purposes, the principal basic record from the viewpoint of management is the balance-of-stores record shown in Fig. 47. The balance-of-stores record gives the amount ordered, received, issued, balance on hand, the amount apportioned, and the amount available. This gives a complete picture of the status of stores. Another important stores record is the bin tag which is maintained on the bin or shelf where the actual material is stored. A description of the material by name and number, with the amounts received and issued, the balance on hand, the low and high inventory limits, when to order, and when to stop ordering is kept on this bin tag in the form of a constant running or perpetual inventory. The amount in stores can be seen at any time, by glancing at the bin tag, if the record is kept up to date. Some companies maintain a visual record of the balance of stores with colored tabs indicating the amount on hand, the amount in process, when to order, the amounts to order, and the total inventory involved. Though accurate records are kept, an actual inventory should be made periodically to check whether the material actually existing in the bins corresponds to the material on record.

The quantity of stores to be maintained is difficult to decide because of the variables which must be considered, such as the demand, savings by quantity orders, interest on the investment, the time necessary to obtain new material, the probability of change of material, and the conditions of the material itself. For example, demand usually increases with a decrease in size. Normally a larger demand would exist for 3-horsepower motors than for 300-horsepower motors in the average plant.

For some of these factors to be considered in storing material, formulas have been devised¹ to fix the least-cost purchase for quantities of stores. Methods of arranging stores have been found to be important in stores keeping, such as placing them so that they can be seen at all times, and making containers to fit the materials or parts. The bins and shelves may be arranged and designated by a combination of alternate letters and numbers, such as are shown in the following diagram:

¹ See F. L. Eidmann, *Economic Control on Engineering and Manufacturing*, New York: McGraw-Hill Book Co., 1931, p. 99.

	a	b	c	d	e
5					
4					
3					
2					
1					

A

	a	b	c	d	e
5					
4					
3					
2					
1					

B

The storeroom should be located so that the least amount of travel to it will be involved. This may not be the most central location because some departments of the plant may not have to maintain stores and should not be considered. However, it should be as centrally located to those departments using it as possible, considering the amount each department uses it.

All stores necessitate a clear classification and identification of each kind of material, supplies, tools, and equipment for ease of reference, and so that they can be found quickly. The classifications should be adapted to the particular manufacturing process, in order that the management may keep track of where and how its money is spent for stores. They can be made in many ways, such as according to machinery, production materials, tools, supplies, etc., with each piece of stores having an identification by the following means:

1. Alphabetically—by a letter or combination of letters.
2. Numerically—by a number or numbers.
3. By a combination of (1) and (2), such as M110 representing Machine 110.
4. Mnemonically—by letters or by letters and numbers suggestive of the classification or name of the item, which will facilitate easy remembering of the item. For example, at the Gleason Works, R15P means a 15-inch pinion rougher and H15M means a 15-inch hardening machine.

Closely allied to these means of identification is the Dewey decimal system where sub-numbers are given for the parts of an item. For example, a generator may have the number .012 and the armature of that generator .0122. An accurate classification and identification facilitates stores keeping and recording.

From this discussion of stores and stores keeping the following principles may be stated:

1. Stores should be manufactured into stock as soon as is economically possible.

2. The smallest stores inventory possible should be maintained, consistent with production needs.
3. The drawing out of stores should be considered similar to the drawing out of money, and savings in stores as a saving of money.
4. A perpetual inventory should be maintained at all times by means of a balance-of-stores record.
5. An endeavor should be made to predict production needs by means of the stores record.
6. The highest possible number of turnovers of material should be made each year.
7. Receipts and issues should be checked and recorded accurately.
8. Stores should be classified and arranged correctly to facilitate easy identification and location.

MACHINERY AND EQUIPMENT

The importance of machinery and equipment in the management of an up-to-date manufacturing establishment today can be realized by the \$15,000,000 modernization program which the Buick Motor Company carried out to obtain their 1936 business. They purchased 380 new machines and relocated, surplused, or scrapped 5,968 old machines.¹ The objectives of their modernization program were: (1) to reduce costs, (2) to reduce repairs and maintenance costs, (3) to provide for adequate capacity by producing a greater volume on the same floor space, (4) to make necessary engineering changes by the replacement of obsolete equipment and to have precise control of operations, (5) to improve quality, and (6) to improve the working conditions. These objectives were attained through the following channels: (1) purchase of new equipment to cut costs and improve quality, (2) rebuilding and retooling of existing machines, (3) rearrangement of existing machines and conveyors, (4) reduction of the number of machines, (5) smoother flow of materials and parts in process, (6) reduction of waste, (7) increase in volume (as related to cost), (8) simplification of product (reduction from 26 to 14 models).

Of the money spent in the motor plant, 50.5 per cent went for new machinery, 12.5 per cent for rebuilding and repairing machines, 26 per cent for tools and fixtures, and 11 per cent for plant rearrangement. New machines were depreciated on the 10 per cent per year basis. However, it was found that many

¹ *Factory Management and Maintenance*. "Buick's Fifteen Million Dollar Bid." Vol. 93, No. 12, December, 1935, p. 499. Also "Where Buick's Fifteen Million Dollars Went," Vol. 94, No. 1, January, 1936, p. 5; Vol. 94, No. 2, February, 1936, p. 61.

of the machines purchased in 1929 were entirely obsolete for 1936 production.¹ Examples of the changes made can be seen by the fact that in the forge shop 39 new machines were installed and 49 were scrapped or surplused with a greatly increased daily tonnage output. Special-purpose machines were selected in which operations, such as drilling and boring, that would ordinarily be performed on two, three, or four general-purpose machines, were combined.

Though a particular company may not have the need for the modernization of its machinery, every modern manager must have a knowledge of up-to-date machinery and equipment if he is to improve the quality of his product, increase production, reduce costs, and intelligently replace worn-out and obsolete machinery and equipment. He must know the kinds of new equipment generally, the kinds and amounts required for his company, and the first costs as well as the operation costs. He cannot afford to "rent" his old equipment. If he would not buy or rent any machine in his plant it may be that it is obsolete or expensive for him to maintain. One company considers that, if it would not buy or rent its present machinery from another company, that equipment is obsolete, considering, of course, all the conditions and factors involved.

The first consideration necessary to the management of machinery and equipment is a knowledge of the kinds of machinery and equipment. Table XII² lists the general-purpose machines and their uses.

In job order manufacturing, the manager may have to adapt his products to these types of machines. In mass production, special-purpose machines may save in long-run operation. In recent years the trend in machinery development seems to be

¹ An investigation of the number of years during which the initial investment must be returned in 200 manufacturing concerns was investigated by L. P. Alford (*Recent Economic Changes in the United States*; National Bureau of Economic Research, Inc., New York: McGraw-Hill Book Co., Vol. 1, p. 139) and found to be as follows:

- 5.1% wished the investment returned in one year's time.
- 43.6% in two years.
- 64.1% in three years.
- 76.9% in four years.
- 97.4% in five years.
- 100% in less than eight years.

² J. W. Roe and C. W. Lytle. *Factory Equipment*. Scranton, Pa.: International Textbook Co. 1935. P. 430.

towards: simultaneous operations, automaticity, individual motor-driven machines replacing shaft-driven ones, and machine design for positive safety.

TABLE XII
GENERAL-PURPOSE MACHINE TOOLS AND THEIR USE*

Machine	Kind of cut	Typical operation
1. Drill press	Primary operation: drilling rough holes Secondary operations: reaming, or tapping and external spot facing; occasionally turning with formed box-tool	Drilling bolt holes, reaming small bearings, tapping internal threads and occasionally turning small bevel-gear blanks
2. Engine lathe	Circular, internal	Boring concentric pieces such as gear blanks, surfacing concentric pieces such as shafts, surfacing concentric pieces such as gear blanks
Chuck tail-stock (Two set-ups) Face plate and Mandrel	Circular, external	
3. Vertical boring mill	Circular, internal bearings or external journals and surfaces at same time	Boring and surfacing heavy concentric pieces such as flywheels, usually along short axes
4. Horizontal boring machine	Circular, internal and face	Boring several long axes without re-setting, such as multiple cylinder blocks or Corliss engine block
5. Milling machine	Surfacing along linear projections and grooving, external	Slotting or surfacing small and medium-sized pieces, particularly in mass, such as housing and caps; also turning part arcs, as ends of connecting-rods
6. Planer	Flat, near-rectangular surfacing, long and narrow grooving, external	Surfacing V's on lathe beds or cutting keyways in long shafts, usually small lots
7. Shaper	Same, but smaller	Surfacing small rectangular pieces, usually small lot; also special external grooves
8. Slotter	Grooving and keyway cutting, internal	Single grooving or keyway cutting in gears, pulleys, etc.
9. Broaching machines	Non-circular or irregular shapes, generally internal	Making square holes of cutting three keyways in gear bores 120° apart; lately, external surfacing in large quantities

* J. W. Roe and C. W. Lytle. *Factory Equipment*. Scranton, Pa.: International Textbook Co. 1935. P. 430. (See this book for good descriptions of these machines.)

Some machines, such as the Bullard Mult-Au-Matic Machine Tools, combine several of these trends. Examples of further trends and the transition which has taken place in machine tool development is given by the Cincinnati Milling Machine Com-

pany.¹ In 1910 a machine which held four connecting-rods in a special fixture produced 40 per hour, whereas in 1930 a machine which held eight pieces in an automatic index fixture produced 248 per hour. In 1920, 90 valve tappets were ground per hour in the center type grinder with a tolerance of 0.0005 inch, whereas in 1931, by centerless infeed grinding 1,350 could be produced with a tolerance of 0.00025 inch. Other examples come from Buick's modernization program:

One machine rough and finish bores both the large and the small ends of connecting rod forgings, then saws off the cap. Rods are machined four at a time. Formerly, three set-ups were required. Another special-purpose equipment bores the camshaft as well as the main bearings of the cylinder block in one set-up, this being the first time these operations have been combined.

Advantage has been taken of the newest automatic controls. Pistons, for example, are equalized in weight on a special end-milling machine in which the depth of cut is regulated by the weight of the pistons on the weight pan of a scale. The heavier the piston, the lower the pan sinks and the more metal is removed from two internal balancing lugs.

Another example is automatic sizing control of finish grinding on the camshaft, which is accomplished by mercury-column switches actuated pneumatically through orifices controlled by the work size.

An example of revision to improve quality is found in the constant-temperature room where piston sets are matched against the bores of the block in which they are assembled. Piston diameters are measured under large-scale electric gauges, and segregated in ten steps, each step being 0.0003 inch. With a metal of such high expansivity as aluminum, such fine segregation would be impractical unless carried on at a uniform temperature.

Bores are gauged internally in similar steps as the blocks go down to the assembly line. By telautograph the checker reports the motor number and the bore steps in a given sequence. From the written record at the receiving station in the constant-temperature room, pistons are selected to correspond. The torn-off record stays with them as they are assembled to connecting-rods and placed on trays carried on monorails. By the time the tray reaches the assembly line, it is above the motor to which its cargo belongs.²

From these examples, it can be readily seen that the selection of the right machinery and equipment is a very important phase of modern management.

The prime considerations in the selection of machinery are: the investment which is justified in the installation of the new machine, the savings that will accrue from its purchase, the years in which the new equipment will pay for itself, and whether the unit cost of production is cheaper with the new or proposed

¹ S. Einstein. "Machine Tool Milestones, Past and Future." *Mechanical Engineer*. Vol. 52. No. 11. P. 959. November, 1930.

² *Factory Management and Maintenance*. February, 1936. P. 61.

method than with the present method. For the purpose of solving these prime machinery considerations and problems, a number of formulas for the selection of new machinery and equipment have been developed. Probably the most widely used are those developed by the Materials Handling Division of the American Society of Mechanical Engineers as follows:

FORMULAS FOR COMPUTING ECONOMIES OF LABOR-SAVING EQUIPMENT¹

Let

Debit factors	{	A = percentage allowance on investment.
		B = percentage allowance to provide for insurance, taxes, etc.
		C = percentage allowance to provide for upkeep.
		D = percentage allowance to provide for depreciation and obsolescence.
		E = yearly cost of power, supplies, and other items which are consumed, total in dollars.
Credit factors	{	S = yearly saving in direct cost of labor, in dollars.
		T_a = yearly saving in labor burden, in dollars.
		T_b = yearly fixed charges on mechanical equipment employed as a standard of comparison or which will be displaced, in dollars.
		U = yearly saving or earning through increased production, in dollars.
		X = percentage of year (percentage of working time) during which equipment will be employed.
Results	{	I = initial cost of mechanical equipment, in dollars.
		K = unamortized value of equipment displaced, less its resale or scrap value, in dollars.
		Z = maximum investment in dollars justified by the above consideration.
		Y = yearly cost to maintain mechanical equipment ready for operation, in dollars.
		V = yearly profit from operation of mechanical equipment, in dollars.
		P = percentage of annual profit on investment, including interest charges.
		H = number of years required to pay for installation.

¹ *Trans. A. S. M. E.* Vol. 47. P. 525. 1925.

Then

$$Z = \left[\frac{(S + T_a + U - E)X + T_b}{A + B + C + D} \right] - K$$

$$Y = I(A + B + C + D)$$

$$V = [(S + T_a + U - E)X + T_b] - [Y + (KA)]$$

$$P = \frac{V}{I} + A$$

$$H = \frac{100 \text{ per cent}}{P + D}$$

Roe and Lytle¹ have devised the following formulas to determine, by comparing the results of the two, whether a proposed method is better than the present method in the selection of equipment, from the standpoint of cost per unit of production, and giving consideration to capital, operating, and miscellaneous items:

PRESENT METHOD		PROPOSED METHOD
CAPITAL ITEMS		
<i>E</i>	Equipment cost	<i>e</i>
<i>I</i>	Interest per year in percentage of investment	<i>i</i>
<i>D</i>	Depreciation and obsolescence in percentage of investment	<i>d</i>
<i>T</i>	Taxes and insurance in percentage of investment	<i>t</i>
<i>M</i>	Maintenance and repairs in percentage of investment	<i>m</i>
OPERATING ITEMS		
<i>P</i>	Power and supplies consumed	<i>p</i>
<i>W</i>	Wages per year	<i>w</i>
<i>B</i>	Burden per year in percentage of wages	<i>b</i>
MISCELLANEOUS ITEMS		
<i>N</i>	Number of units produced annually	<i>n</i>
<i>F</i>	Saving in floor space	<i>f</i>
<i>C</i>	Total cost per unit of production	<i>c</i>

¹ Roe and Lytle. *Op. cit.* Pp. 435-6.

$$C = \frac{\overset{\text{capital items}}{E(I + D + T + M)} + \overset{\text{operating items}}{P + W + WB} - F}{N}$$

$$c = \frac{e(i + d + t + m) + p + w + wb - f}{n}$$

Although the process of selecting machinery cannot always be formularized or codified, many companies find that final decisions must be left in the hands of experienced men who exercise discrimination in the weighting of machine characteristics. The following is an outline of the general practical procedures for selecting manufacturing machinery and equipment by the Western Electric Company¹ in Chicago.

PROCEDURE FOR SELECTING MANUFACTURING EQUIPMENT
FOR THE WESTERN ELECTRIC COMPANY, INC.

(MACHINE TOOLS)

1. *Sources of Information Regarding Machine Tool Equipment Available on the Market:*
 - 1.1 Catalogue file of domestic and foreign machine tool suppliers.
 - 1.2 Trade journal announcements and advertisements of new machine tools.
 - 1.3 Suppliers' representatives.
 - 1.4 Machine tool exhibits.
 - 1.5 Visits to machine tool suppliers' plants.
 - 1.6 Visits to plants of other manufacturers.
2. *Items Considered in the Selection of Machine Tools:*
 - 2.1 Purpose of proposed machine. Kind and number of parts to be made annually. Probable length of time this product will be manufactured.
 - 2.2 Output of proposed machine. Number of machines required.
 - 2.3 Ease of operation and ease of tool set-up.
 - 2.4 Estimated tool cost per unit number of parts.
 - 2.5 Estimated cost of product when made on proposed machine tool and tool set-up.
 - 2.6 Consideration as to whether the proposed machine should be a strictly single-purpose machine suitable only for one product or whether it should be of a kind easily modified or retooled to make other parts.
 - 2.7 Consideration of the past performance of similar machines of older type, if available in our plant.
 - 2.8 Consideration as to whether the proposed machine is consistent with present plans for standardization of machine tools and their auxiliary small tools.
 - 2.9 Check of the dimensions and operation of component parts of the machine to determine its suitability for handling the work desired.

¹Prepared for the author by Mr. H. C. Beal, Operating Superintendent, Hawthorne Works, Western Electric Co., Chicago, Ill., in 1935.

- 2.91 Kind of drive.
- 2.92 Method of lubrication.
- 2.93 Method for changing speeds.
- 2.94 Floor space required by machine.
- 2.10 Workmanship: quality of materials, character and accuracy of machined surfaces, bearings, fits of moving parts, etc.
- 2.11 Reliability of supplier.
- 2.12 Initial cost of machine.
- 2.13 Estimated cost of installation.
- 2.14 Estimated cost of adequate guarding.
- 2.15 Possibilities for premature obsolescence due to characteristics peculiar to the proposed equipment.

PROCEDURE FOR SELECTING MANUFACTURING EQUIPMENT
USED BY THE WESTERN ELECTRIC COMPANY, INC.

The Western Electric Company, Incorporated, manufactures telephones, central office telephone plant equipment, and miscellaneous apparatus for communication purposes. Approximately 21,000 different pieces of apparatus are manufactured, embodying about 121,000 different piece parts. For their manufacture, practically every type of standard machine tool, suitable for the manufacture of small parts, is used. In addition to these, many special machines are also required.

Special equipment, the functions of which are determined by the processes involved, such as cable stranding machinery, braiding machinery, etc., is selected by the engineers functionally responsible for the methods of manufacture, quality and improvement of the particular product.

The selection of all machine tool equipment such as punch presses, drilling machines, automatic screw machines, grinders, etc., is delegated to one organization in order to insure that the equipment provided is in keeping with definite plans for standardization and that it is the best equipment available on the market and is properly suited for the work at hand.

The attached outline shows in general the processes by which machine tools are selected. Other equipment provided for special processes is selected in a similar manner.

In the selection of a machine required for a particular purpose, the significant details of design and construction of a number of machines offered by several suppliers are charted on a single sheet of paper and scrutinized. By this method, the machine having the largest number of characteristics indicating a superiority for the work under consideration can be readily noted. Then, in addition to this technical consideration, the machine is further subjected to further scrutiny as covered in the more general items shown under 2.0, of the attached outline.

In the selection of manufacturing equipment there are several other more general considerations which are followed by this Company:

1. The Company aims to have more than one approved supplier for each class of machine tool equipment.
2. Inasmuch as this Company has found in the past that ease of rearrangement of manufacturing equipment facilitates cost reduction efforts they have

pioneered the use of individual motor drives mounted on machine tools. In this connection, it should be noted that the Western Electric Company does not manufacture electric motors or other power equipment and therefore the decision in favor of direct motor drives has been based on strictly economic grounds.

3. In our selection of machine tools, those made by domestic suppliers are given preference provided all other considerations are equal. It has been found expedient, however, in a few cases to obtain some equipment from abroad, when foreign machines have shown a decided superiority for the purpose required.

4. For economic reasons standard equipment of machine tool suppliers is selected wherever possible. If auxiliary attachments are required for the operation of any machine, those which are also standard with the supplier are obtained if possible.

5. In cases where it is determined that no standard machine will produce economically the desired product, a specification is prepared outlining the requirements and a number of suppliers are asked for their suggestions, comments, and preliminary quotations based on this specification. From the results obtained from this procedure, a more detailed and definite specification is prepared and returned to the same suppliers. These definite specifications usually result in the receipt of quotations which are scrutinized both on the basis of the attached general outline and also with regard to a more detailed outline of the design characteristic prepared to cover specifically the proposed machine.

Attached are two specifications which illustrate, in general, the form of a preliminary specification and a final form of specification submitted for the definite quotations.

Machines required for a very special process peculiar to the telephone industry are given special consideration. In such cases if a machine which will perform the desired operations cannot be economically furnished by outside suppliers in accordance with our specifications, the Western Electric Company designs and builds the special equipment needed for accomplishing the desired results.

Item	DOUBLE HEAD PLANER			
	Manufacturer "A"	Manufacturer "B"	Manufacturer "C"	Preferred
Price	\$6,200	\$5,561		
Weight	13,000	10,700	11,200	"A" by 2,300 lb.
Feed	4 speeds with drum control	4 speeds with drum control	4 speeds with drum control	Equal
Motors	Built in	Set on bracket	Standard housing on head	"A" preferred
Cutter Heads	4 knife 5 in. diameter Milled pockets for knife bolts	4 knife 3 1/4 in. diameter Milled slot for knife bolts	4 knife Milled slot for knife bolts	"A" preferred on account of strength
Cutter Head Bearings	Ball	Ball	Ball	Equal
Feed gears and belt	No belt machine cut gears running in oil	Intermediate belt, machine cut gears not in oil	No belt, machine cut gears not in oil	"A" because gears are in oil and no belt required
Hoist	Power raise and lower through spiral cut spur gears and wedge clutch	Power raise and lower through bevel gears, no clutch	Power raise and lower, bevel gears and drum clutch	"B" because it is free from trouble

Item	Manufacturer "A"	Manufacturer "B"	Manufacturer "C"	Preferred
Controls	Push-button relay in machine	Push-button relay in box bolted to machine	Push-button relay in box bolted to machine	"A" because of neatness
Tables	Set on springs	Rigid	Rigid	"A" because stock enters more easily
Feed roll pressure	Springs	Springs	Springs	Equal
Chip breaker	Sectional top and bottom. Each move concentric with cutter head	Sectional top, flexible bottom. Each move concentric with cutter head	Sectional top, flexible bottom. Does not move concentric with cutter head	"A" because each chip breaker is of sectional type. "B" second because chip breaker is concentric with cutter head
Platen Adjustments	Hardened steel Micr. dials for cutter heads, wedge adjustments for parallel work	Chilled iron Scale for cutter heads. No wedge adjustment for parallel work	Chilled iron Scale for cutter heads. No wedge adjustment for parallel work	"A"
Set-up Grinding of cutter heads	Medium Attachments for top and bottom heads in position	Fast Set bar for top head and remove bottom head	Slow Bar for top head in place, bottom head moves out and rests on stand	"B" "A"
Feed roll bearings	Roller	Bronze	Bronze	"A"
Feed rolls	Sectional shell wall $\frac{3}{8}$ in.	Sectional shell wall $\frac{3}{8}$ in.	Sectional	"A"
Grade of work obtained	Good	Good	Fair	"A" or "B"
Class of service	Question. Have had considerable trouble with hoist mechanism	Dependable	Should receive dependable service	"B"
General appearance	Excellent	Fair	Good	"A"

LIGHTING¹

The difficulties which man has placed upon himself by coming indoors to work may be seen more clearly by a comparison of daylight illumination outdoors to artificial light indoors. The illumination from the sky only, at midday, was found by the United States Weather Bureau² to be about 700 foot-candles in December and about 1,600 in June. The daylight from the sun and sky was found to be about 3,700 foot-candles in December and more than 10,000 in June. On a densely clouded day when the position of the sun cannot be seen, the average illumination in December was found to be around 900 foot-candles at noon, and about 2,700 at the same time of day in June. In many manufacturing establishments, 15 foot-candles illumination is considered excellent. From this comparison of 15 foot-candles for good lighting indoors, to 900 on a cloudy

¹ M. Luckiesh and Frank K. Moss. *The New Science of Lighting*. Cleveland: General Electric Co. 1934. Also *Seeing; A Partnership of Lighting and Vision*. Baltimore: Williams & Wilkins Co. 1931.

² *Monthly Weather Rev.* Vol. 47. Pp. 769-73. November, 1919. Also Vol. 49. Pp. 481-8. September, 1921.

day outdoors, we might conclude that the lighting for good work indoors, in general, is inadequate. In many cases increases in lighting has been found to increase production over and above the cost of the extra illumination. Table XIII gives a number of typical examples of increases in production due to increases

TABLE XIII

TYPICAL EXAMPLES OF THE INCREASE IN PRODUCTION RESULTING FROM BETTER LIGHTING*

Nature of work	Average intensity with old system candles	Average intensity with new system candles	Percentage increase in production obtained	Additional cost of lighting in percentage of payroll
Pulley finishing.....	0.2	4.8	35	5.
Soft metal bearings.....	4.6	12.7	15	1.2
Heavy steel machining.....	3	11.5	10	1.2
Carburetor assembly.....	2.1	12.3	12	0.9
Electric and gas iron manufacturing.....	0.7	13.5	12	2.5
Semi-automatic buffing shell-sockets.....	3.8	11.4	8.5	1.8
Letter sorting.....	3.6	8.0	4.4	0.6

* M. Luckiesh and F. K. Moss. *Seeing*. P. 226.

in illumination. However, Dr. Luckiesh contends that the increase in production resulting from better lighting is only a small part of the science of lighting. He and his colleagues have developed a new science of lighting.¹ Dr. Luckiesh views this situation as follows:

The old ideas upon which lighting was vaguely and at best insecurely based are fast disappearing. The development of the new science of seeing, through our researches over the past two decades and particularly the last one, is really making a science of lighting out of a very crude art. The production basis falls far short of a proper one for specifying lighting in industries. At best, production ceases to increase appreciably after 20 foot-candles have been supplied. However, ease of seeing continues to increase as the intensity of illumination is increased to hundreds and even thousands of foot-candles in cases of severe visual tasks.²

These illumination engineers are now beginning to consider people as *human seeing machines* who waste their energy in useless work when the illumination is inadequate. A chart of this wasted energy is shown in Fig. 48. This emphasis upon people

¹ M. Luckiesh and F. K. Moss. *The New Science of Lighting*.

² From a letter from M. Luckiesh to the author, Oct. 5, 1934.

as human seeing machines brings the subject of individual differences into lighting and seeing. What may be excellent lighting for one individual may be poor lighting for another. For maximum ease of reading, under the same general conditions, 11 per cent of a group of 82 subjects selected 10 foot-candles; 18 per cent, 20 foot-candles; 20 per cent, 100 foot-candles; 17 per cent, 200 foot-candles; 1 per cent, 500 foot-candles; and 1 per

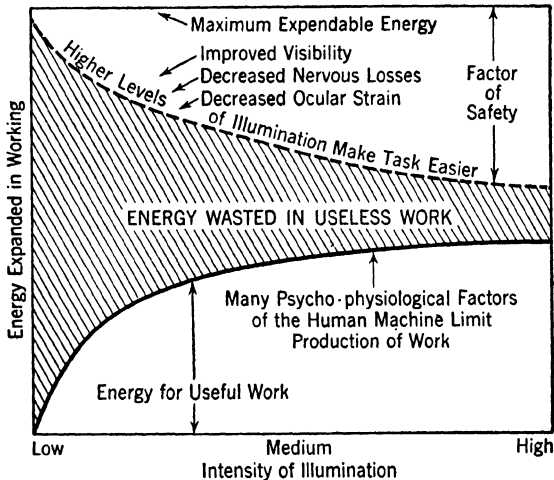


FIG. 48.—An interpretation of the relationships between lighting, production of work and the expenditure of human resources. The solid line represents the relative energy expended in useful work as determined by many researches. The dotted line shows the total energy expended in the performance of visual work and is a representation of indirect knowledge and experience rather than definite research results. (M. Luckiesh and F. K. Moss, *Seeing*. Op. cit. P. 10.)

cent selected 1,000 foot-candles.¹ If the ease of seeing is considered rather than just visibility, the intensity of illumination should be varied in geometric increments in order to secure increments of improvements in seeing.² From this principle, the following approximate scale of foot-candle effectiveness has been proposed: 1, 2, 5, 10, 20, 50, 100, 200, 300, 500, 1,000.

The effect of the intensity of illumination upon the speed of reading is shown in Fig. 49.³ In general, the following foot-

¹ M. Luckiesh and F. K. Moss. *The New Science of Lighting*. Pp. 21-2.

² M. Luckiesh and F. K. Moss. *The New Science of Lighting*. Pp. 20-1.

³ The implications of the factors represented in Fig. 49 can be taken for manufacturing as well. This opens up a large field of investigation on intensities in the work-world.

candle recommendations for common tasks of the work-world have been given as conservative:¹

- 100 *foot-candles or more*—for very severe and prolonged tasks, such as fine needlework, fine engraving, fine penwork, fine assembly, sewing on dark goods, and discrimination of fine details of low contrast, as in inspection.
- 50 to 100 *foot-candles*—for severe and prolonged tasks, such as proof-reading, drafting, difficult reading, watch repairing, fine machine-work, average sewing and other needlework.
- 20 to 50 *foot-candles*—for moderately critical and prolonged tasks, such as clerical work, ordinary reading, common benchwork, and average sewing and other needlework on light goods.
- 10 to 20 *foot-candles*—for moderate and prolonged tasks of office and factory, and when not prolonged, ordinary reading and sewing on light goods.
- 5 to 10 *foot-candles*—for visually controlled work in which seeing is important, but more or less interrupted or casual and does not involve discrimination of fine details or low contrasts.
- 0 to 5 *foot-candles*—the danger zone for severe visual tasks, and for quick and certain seeing. Satisfactory for perceiving larger objects and for casual seeing.²

The quantity of light is only one of the major factors in lighting. The others are quality of light, spectral character of light, and the quality of lighting. In general, white light or average daylight seems to be the logical illuminant for general use, with exceptions, of course. With reference to the quality of lighting, light sources for small areas should have high brightness and for large areas low brightness as the most effective on the basis of admitting light to the eyes. Both the immediate visual field or visual task and the general surroundings affect the quality of light. Under certain conditions, glare wastes as much as 80 per cent of the illumination supplied. High lights and shadows play important parts in seeing. Therefore, "general lighting plus supplementary lighting offers a practicable means for obtaining the levels of illumination to which the eyes are entitled."²

In the past, lighting was principally an engineering science, but today it is a combination of a physical science—the production and control of light—and a psychophysiological science—the specification of light and lighting. With the introduction of

¹ M. Luckiesh and F. K. Moss. *The New Science of Lighting*. P. 21.

² M. Luckiesh and F. K. Moss. *The New Science of Lighting*. P. 29.

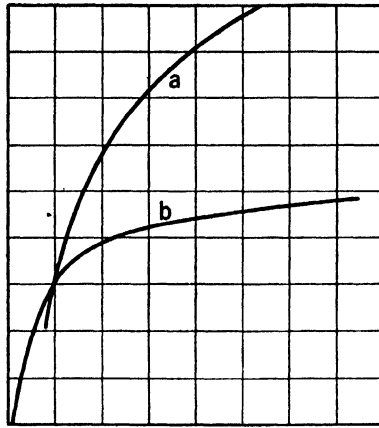


FIG. 49.—Speed of reading. Effect of intensity of illumination upon the speed of reading: Curve *b* shows results obtained for blank type on a white paper. Curve *a* shows results for the black type on a gray paper of 23 per cent reflection-factor. These data represent an average of 43 observers. The curves have been arbitrarily crossed at 4 foot-candles so as to strikingly illustrate the difference in their shapes. It is seen that speed of reading does not increase rapidly beyond 16 foot-candles for the high contrast reading matter, but that there is no indication of an optimum in speed of reading for the low-contrast reading matter for the same range of foot-candles. (M. Luckiesh and F. K. Moss, *Seeing: A Partnership of Lighting and Vision*, Baltimore: The William & Wilkins Co. 1931. P. 223.)

the psychological and physiological factors in seeing, Luckiesh introduces such subjects as the following:

PHYSIOLOGIC OPTICS	PHYSIOLOGY	PATHOLOGY	PSYCHOLOGY
Visual acuity	Nervous tension	Nearsightedness	Impression
Speed of vision	Eyestrain	Inflammation of eyes	Stimulation
Contrast sensitivity	Headaches	Digestive disorders	Confidence

Though the major factors of lighting have been mentioned briefly, still other factors enter into seeing:

- The visual task.
- The visual sense.
- Psychophysiological effects of seeing.

The visual task is affected by the size, critical detail, level of brightness, contrast in brightness and color, and the time required or available for seeing. Contrast has been found to be a very important factor in the visual task; thus, seeing requires a large factor of safety above the threshold of visibility.

Eye defects or distractions affect the efficacy of the visual task. When we realize that an average of 20 to 40 per cent of the masons, printers, and machinists have ocular or eyestrain diseases, that 60 to 80 per cent of the housewives, textile workers, chemists, and musicians, and 80 to 100 per cent of high-school and college students, lawyers, teachers, bookkeepers, tailors, etc., have such ocular and eyestrain diseases, we can realize the importance of such eye defects or distractions upon seeing. The eyes compensate for poor visual conditions and they are injured in doing so, but are slow to complain of the abuse.

A good example is furnished by a man who had given good service on a punch press for eight years. His production decreased and part of his work became defective. They overhauled the machine and even had the manufacturer's representative visit the plant to inspect the machine, but no defects were discovered in it. After puzzling over the decrease in production and the defects in the work, the worker was examined physically and a defect was found in one of his eyes. When it was cleared up he resumed his former quality and quantity of production. It was also found that the low quantity and quality of light were partly responsible for the trouble with the man's eye.

Besides the effects mentioned above, the psychophysiological effects may be even greater. Long-continued periods of exacting visual work, the loss of sleep, lack of recreation, and various other factors affect seeing greatly.

In general summary, then, adequate constant non-glare illumination has a human as well as a dollar and cents value. Because of this, the recent trend seems to be to control light for illumination without glare.

In order to obtain the correct effects of lighting and seeing, some of the most up-to-date plants have been constructed without windows, but with adequate uniform non-glare artificial illumination. A good example of this type of illumination is that designed for the Simonds Saw and Steel Company at Fitchburg, Massachusetts.

Though this preceding discussion of lighting involves general principles, there has to be an actual installation of lighting equipment to provide for them. It may be direct lighting, indirect, or semi-indirect. The lighting has been general, group, or local. The lights themselves may be of the mercury-vapor type or

the regular Mazda, or combinations of these two and others. Tables giving past experience in regard to spacing between outlets and the mounting height above the work or the floor have been developed.

The type of work to be performed and the working conditions determine the foot-candle power of lighting needed, as given previously in this section of this chapter.

After the proper number of foot-candles have been determined, the lighting units, their utilization and depreciation, the number and location of outlets, mounting heights, and light sizes must be determined. It is not to be inferred, however, that the intensity of lighting is to be left to the judgment of the manager. This should be measured by a foot-candle meter, for, usually, personal judgment of the foot-candle power of artificial light is poor. The proper intensity is, usually, very much less than outdoor actual daylight. Nevertheless, adequate lighting and seeing are extremely important to production and management, both physically and mentally.

POWER, HEATING, AND AIR CONDITIONING

The economical procurement and use of industry's power is one of the modern industrial manager's important problems, and it forces him to take advantage of improvements in methods and equipment for producing that power if he is to compete in the open market. This is the power age.

A few years ago boiler efficiencies ranged around 50 per cent, whereas today an efficiency of 80 per cent can be obtained somewhat easily. Similar efficiency differences may exist between other types of old and new power equipment. It behooves the up-to-date manager to obtain his power at the lowest possible cost. As examples of some of the possible improvements in methods and power equipment, a few of the recent trends follow: development of stokers that will handle cheaper grades of coal, thereby saving 50 to 75 cents a ton in the cost of coal; the use of pulverized fuel; grouping together, at a desired point or points, more accurate and reliable instruments for recording pressure, temperature, and draft in order to make a continuous record of operating efficiencies; the installation of water-cooled furnace walls; the preheating of air; the reduction of boiler space by the use of the built-in features in the new-type boilers; more constant steam temperatures by improved superheating; the sub-

stitution of Diesel engines to provide power; the use of boiler pressures from 400 to 700 pounds per square inch instead of around 150 pounds; and the use of higher temperatures.

The average costs for the typical factory power plant have been estimated as follows:¹

The following are average costs for the average factory power plant; in specific cases there may be a considerable variation in either direction:

In the average factory working 48 hours a week, with a fairly steady power load, 1 kilowatt of installed generator capacity will generate approximately 1,500 kilowatt-hours a year, allowing for a reasonable proportion of spare equipment. If a factory works more than 48 hours a week, this annual output will vary in proportion.

A factory working 48 hours a week and purchasing 900,000 kilowatt-hours a year would need 600 kilowatts of generator capacity, if installing its own plant. The plant might consist of three 200-kw. units or two 250-kw. units and one 125-kw. units, making it possible to shut down any unit for repairs. Of course, many single-units plants operate successfully for years without interruption during working hours, but conservative practice calls for a spare unit.

If three or more units are installed, the investment in the spare unit may be minimized. It is often advisable to have a small unit for periods of light load.

Installation costs for the more efficient types of engine-driven generator units, with foundations, steam and exhaust piping, generator panels and wiring, will approach \$100 a kilowatt in sizes up to 300 or 400 kilowatts.

For Diesel engines this figure is about \$100 to \$120 a kilowatt.

Interest, taxes, insurance, and amortization should be figured at 10 per cent on the average factory power plant installation cost. On this basis the fixed charges per kilowatt-hour of current generated will run $\frac{1}{2}$ to $\frac{3}{4}$ cent. To this figure must also be added the cost of fuel, labor, supplies, and repairs.

Fuel costs vary with the locality, but with average boiler conditions it may be assumed that 1 pound of soft coal will evaporate 10 pounds of water. If a non-condensing engine uses 40 pounds of steam a kilowatt-hour, 4 pounds of coal will be required to make the steam. On this basis, a ton of coal will produce 500 kilowatt-hours. Allowing for condensation in pipes and for lower efficiency under light loads, the average might be taken at 400 kilowatt-hours a ton. If coal costs \$6 a ton, the unit fuel cost will be $1\frac{1}{2}$ cents a kilowatt-hour.

In some plants where the mechanical equipment is elaborate and high-pressure steam is required throughout the year, little or no additional labor may be required to operate generating equipment. Elsewhere, one or more additional employees may be required. Their wages must be divided among the total kilowatt-hours generated during the year.

Thus, if an additional engineer receiving \$2,500 a year is required, and

¹ J. K. Campbell. "Find the Cheapest Source of Electrical Energy." *Factory Management and Maintenance*. Vol. 93. No. 10. October, 1935. P. 8-117-8.

the plant generates 1,000,000 kilowatt-hours a year, the labor cost will be $\frac{1}{4}$ cent a kilowatt-hour.

Supplies including oil, waste, packing, and ordinary repairs such as occasional reboring of cylinders and refitting of valves, may amount to 1 to 2 mills a kilowatt-hour.

Summarizing the above costs in cents per kilowatt-hour gives:

Fixed charges	0.60
Fuel	1.50
Labor	0.25
Supplies and repairs.....	0.15
Total	2.50

It will be seen that the fuel cost accounts for all but 1 cent of the total. It is difficult to reduce the items entering into this total, but the fuel cost depends almost entirely upon how much of the exhaust steam can be usefully employed. If two-thirds of it can be utilized, which is not unusual, the net fuel cost will be $\frac{1}{2}$ cent, and the total cost of electricity will be $1\frac{1}{2}$ cents a kilowatt-hour.

A Diesel engine does not produce exhaust steam, but the fuel cost is low, probably below 1 cent a kilowatt-hour, so that the total of all the items listed in the above summary may be below 2 cents a kilowatt-hour.

This estimation shows the average fuel cost to be about 60 per cent of the total. Therefore, it is essential to consider not only the price to be paid for the fuel, but also how efficiently that fuel is used. A low-priced fuel may result in higher furnace and repair costs and lower efficiencies. Nevertheless, it may be possible with improved equipment to use low-priced fuel and maintain the same efficiency. However, the locality and operating personnel may impose limitations upon the manager or the engineer in his choice of fuels. In general, efficiency depends upon the design and operating conditions and personnel. Each manager should know his power efficiencies from engineering tests made by an experienced engineer. These tests should give comparative inefficiencies.

From the standpoint of operation costs it is generally considered that low labor and supervision costs are not necessarily efficient. From the standpoint of repairs, it is a general rule that repairs should be made before conditions become urgent. This is the reason that many states require by law regular inspections of boilers.

One of the principal lasting discussions among power engineers is the use of exhaust or waste steam. Practically all plants require some heating and many require a supply of hot water and

steam for their processing operations. The provision of power, then, is closely tied up with heating and the provision for hot water and steam for processing operations. If the plant does not require such steam and hot water for heating and processing, it may be lost in waste. Where there is no use for this exhaust steam, some companies use Diesel engines which do not have exhaust steam.

Where a heating system is combined with power development, the aim of the power engineer is to maintain a heat balance, that is, where there is little or no steam wasted or exhausted to the atmosphere at any time. In some companies this is difficult because of the seasonal variations in the requirements of steam for heating and processing. Adjustments must be made to the conditions of the individual plant. The requirements of an individual concern in the use of this exhaust steam may also restrict the use of certain types of power equipment. For example, if a high-temperature steam is required for an industrial process, a moderate-temperature boiler could not be used. Some of the methods of maintaining a heat balance are: by adequate insulation of piping and by provisions for adequate, up-to-date steam traps, such as the inverted bucket types which have come into considerable favor in recent years; by proper condensing equipment, an exhaust steam turbine, a steam accumulator for hot water storage, and other methods. However, to secure the most economical power and heating results all the factors must be carefully considered, surveyed, and coordinated. Some of these considerations are that the distribution system must be arranged for flexibility with minimum losses, such as the multiple feeder system, the tree feeder system, and the ring feeder system.¹

Besides the general distribution methods from the prime mover, it is essential to consider the methods of transmitting power from the prime mover to the driven machine, such as the individual drive where each machine has its own motor, or the group drive where two or more machines are driven from the common line shaft. The individual drives permit easier and more economical changes in plant and machine layout, wider variations and control of speeds, greater flexibility, and clear space above machines for overhead cranes and equipment; moreover, production is not seriously handicapped by the failure of

¹ See Frederic Oakhill, "Arrange for Flexible Distribution with Minimum Losses," *Factory Management and Maintenance*, Vol. 93, No. 10, October, 1935, p. S-119.

one motor. One of the chief difficulties in the individual drive is the initial cost, which is usually from 75 to 200 per cent higher. Likewise, the annual fixed charges are more for individual drives than for group drives. Where the benefits from individual drives are possible and are not overbalanced by the initial cost and fixed charges, they should be installed, of course, considering that the group drive may be more suitable where the power required is highly variable with occasional extreme peaks and when the machines are in constant operation.

In general, all power considerations for the most economical results should be based only upon a thorough engineering survey¹ of all the factors entering into the procurement and use of energy, steam, and heat for power heating and operating processes.

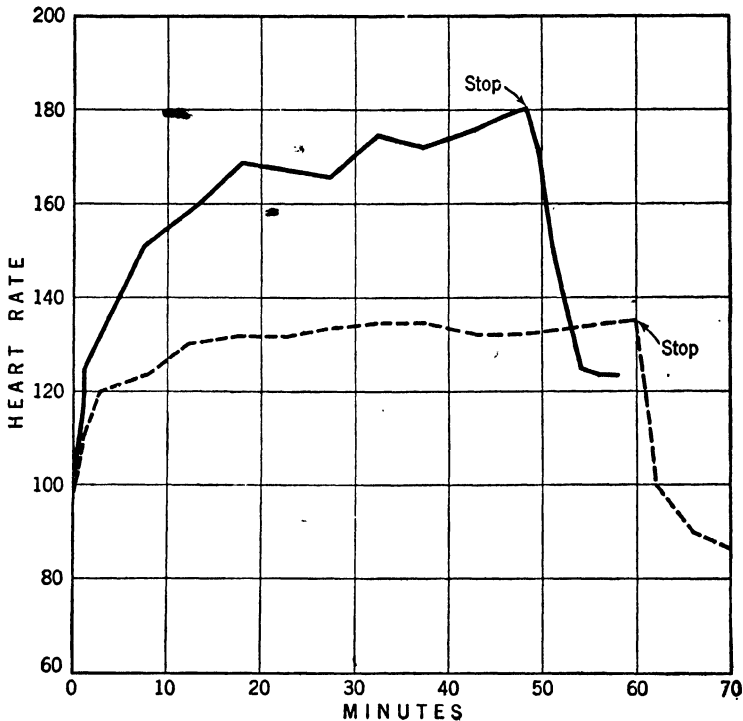
In this whole discussion of the production of power at the most economical cost comes the question of whether it is more economical to purchase or to generate energy. Although the answer must of necessity vary according to the conditions, certain trends have developed in the thinking of power engineers which seem to be as follows: if the demand for exhaust steam is small it is usually cheaper to purchase than to generate steam in a steam-driven plant; if a continuous supply of low-pressure steam is required it may be cheaper to generate than to purchase. This general rule is, of course, conditioned upon the maintenance of the proper heat balance. Also, if no low-pressure steam is required, it may be cheaper to install Diesel engine equipment.

Closely connected with producing power is the heating of the factory. Heat has a decided physiological effect upon the worker, as shown in Fig. 50, and this fact should enter into the manager's considerations. In recent years this subject of heating has been so closely associated with the subject of air conditioning that for the purpose of this discussion it will be included as a part of that subject. Air conditioning has come to involve the constant and simultaneous control of temperature (heating and cooling), humidity, air motion, distribution, and purification. Some of the most up-to-date companies consider the factory as one great production machine, closely coordinated, with all conditions controlled, in what is called the "controlled conditions plant."²

¹ For sample questions of such a survey see *Factory Management and Maintenance*, Vol. 93, No. 10, October, 1935, pp. S-130-1.

² The Austin Company. *Controlled Conditioned Plant*. Cleveland, Ohio. 1931.

Not only the temperature, humidity, and purity of the air are controlled, but also the method of production, the work shifts, plant layout, quality, light, sound, color, and various other factors. However, for considering air-conditioning problems, the American Society of Heating and Ventilating Engineers has pre-



Solid line —, in hot room, no air movements, approx. 95° F.

Dotted line - - - -, in cold room, approx. 50° F.

Same subject in both tests.

FIG. 50.—Heart rate; results of exercise on an ercometer. (Harvard Fatigue Laboratory, Dr. D. B. Dill.) (Elton Mayo. *The Human Problems of an Industrial Civilization*. New York: Macmillan Co. 1933. P. 20.)

pared a comfort chart giving the relationship between the relative humidity in percentage and temperatures indoors as shown in Fig. 51. Some of the methods used to control temperature, humidity, and purity follow. Heating may be accomplished by gravity or forced circulation of the one or two pipe systems, usually through cast-iron radiators or pipe coils. In recent years the use of suspended or floor types of unit heaters has come into

wide acceptance because of the small space required, ease of location and of control, and the simple piping system required.

Air may be kept fresh by roof ventilators or the central or group forced exhaust system. The air can be warmed or cooled by increasing or decreasing the air motion, by controlling the moisture content, or by removing from or adding to the heat

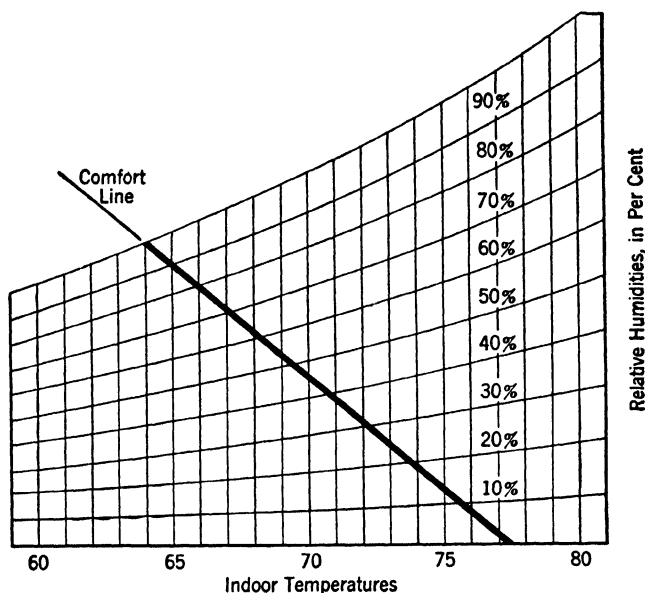


FIG. 51.—Comfort chart of humidities and temperatures. (Prepared by the American Society of Heating and Ventilating Engineers.)

content, according to the comfort line in Fig. 51. Humidity may be increased by the introduction of water into the air by means of a fine spray or mist, or by passing the air through a spray of water in an enclosed chamber. Conversely, too humid air may be dried. Air may be purified by passing it through air washers, sprays of water, wetted plates, or viscous or dry filters.

Air conditioning has great effects not only upon the people in the plant, but also upon the products and the profits. For example, manufacturers of the following have found air conditioning essential to their manufacturing processes: bakery supplies, candy, chemicals, food, meat, photographic films, printing, textile, corn and sugar products, and rayon.

MAINTENANCE

The increased percentage of net property investment to the total assets in industry, the increased mechanization, and the greater emphasis upon working conditions and quality make maintenance management more important today than previously. As maintenance in a manufacturing plant is the function of maintaining buildings, machinery, and equipment in efficient operation, the personnel in charge of this work are primarily interested in the upkeep of all the materials and machinery so that they will operate efficiently when they are needed. This involves the maintenance of buildings, mechanical and electrical machinery, and services. The maintenance of buildings involves: the upkeep of roofs, walls, floors, painting, lockers, and washrooms; heating and air conditioning; piping and plumbing; cleaning; landscaping; and minor construction. The maintenance of mechanical and electrical machinery and equipment involves: the services in connection with the power supply, transmission, and distribution, motive and control application and upkeep, the inspection, cleaning, lubrication, and upkeep of production equipment, lighting, safety, and welding services; and maintenance and stores services.

In recent years there have developed certain methods of maintenance, such as the regular periodic inspection and checking of the different phases of maintenance. Elevator gates are checked daily, scales weekly, pumps monthly, electric lamps semi-annually, and power equipment annually. With these standard inspection times and approved standards for actually making the inspections, and with adequate records of those inspections and accurate costs, maintenance may be controlled to be the least ratio to production costs. Assistance to that end may be obtained by budget and time allowances for maintenance work. Some companies set standards on the time allowed for performing maintenance service and offer incentives for better than the standard achievement. By such methods as these, maintenance is organized and managed at the least cost.

WASTE

Closely allied to the management of materials is that of waste in industry, because material waste may be more readily seen

than other wastes, such as the waste of human energy. Waste is attributable to:¹

1. Low production caused by faulty management of materials, plant, equipment, and men, such as faulty material, design, production, and labor control, the lack of cost control, research, ineffective workmanship, and faulty sales policies.
2. Interrupted production, caused by idle men, idle materials, idle plants, and idle equipment.
3. Restricted production intentionally caused by owners, management, or labor.
4. Lost production caused by ill health, physical defects, and industrial accidents.

To eliminate waste in industry the American Engineering Council recommended the following opportunities and responsibilities:

I. Responsibility of management.

- Improvement of organization and executive control.
- Production control.
- Balancing productive capacity and demand.
- Development of purchasing schedules.
- Elimination of cancellations and curtailment of returns.
- Correlation of production schedules with sales policies.
- Inspection.
- Maintenance of plant and equipment.
- Uniform cost accounting.
- Methods of wage payment.
- Standardization of product.
- Standardization of materials.
- Standardization of equipment.
- Performance standardization.
- Management and workers.
- Prevention of accidents.
- Research.

II. Responsibility of labor.

- For increasing production.
- For standardization of work.
- For changing rules regarding restrictions.
- For improving health and reducing accidents.
- For improving industrial relations.

III. Responsibility of owners.

IV. Responsibility of the public.

- Need of public interest.
- Style changes.

¹ Adapted from the American Engineering Council, *Waste In Industry*, New York: McGraw-Hill Book Co., 1921. p. 8.

Distribution of demand.

Community cooperation with industry.

V. Opportunity of trade associations.

Work for comprehensive organizations.

Industrial standardization.

VI. Opportunity for governmental assistance.

National industrial information service.

A national statistical service.

Principles for adjustment and settlement of labor disputes.

Public health policy.

National program for industrial rehabilitation.

Nation-wide program of industrial standardization.

Revision of federal laws.*

Though the American Engineering Council has proposed an excellent method for the elimination of waste, it still behooves the individual manager to decrease the types of waste which have been mentioned here, through better management or by making use of the waste products themselves. Examples of the use of waste products are: the making of wallboard from the waste product of a cane sugar mill, and the manufacture of chemicals from the waste products of the steel mill. Similar examples which could be cited indefinitely emphasize the need for each manager to consider the use of the waste products of his plant. Some companies have waste-reduction campaigns and competitions, by means of the consequent publicity reducing waste to a minimum.

SPECIAL ASSIGNMENTS

General

1. Report on one of the following methods of a particular company, organization, or department.

- a. Plant location and layout.
- b. Plant construction.
- c. Purchasing.
- d. Materials handling.
- e. Stores.
- f. Selection of machinery.
- g. Lighting.
- h. Power production and heating.
- i. Air conditioning.
- j. Maintenance.
- k. Waste reduction.

Plant Location

2. Locate a plant in a certain locality and tell why it was located there. Assume the product.

3. Select several companies and tell briefly why they were located where they are.

Plant Layout

4. Report on the old and new layouts of a company or department which has made a recent change in layouts.

5. Devise a new layout to replace an old one which now exists, such as a room, house, etc., in which you have considerable activity.

6. Report on "Four Floors to One" by J. A. Buser, *Factory Management and Maintenance*, Vol. 94, No. 4, April, 1936, pp. 148 et seq. (Include both old and new layout of the Motor Division of the Cadillac Motor Car Co.)

7. Report on A. H. Mogensen, "What's Happening to Plant Layout," Reprint *Factory Management and Maintenance*, 1931-5.

Purchasing

8. Report on the specifications for purchasing certain material, such as steel, a boiler, a motor, etc.

9. Apply the purchasing procedure given in the section on purchasing in this chapter to the personal purchase of some article or material.

Machinery and Equipment

10. Consider the purchase of a new coal-handling and ash-handling system for a heating plant. Use the A.S.M.E. formula for determining the wisdom of making this particular purchase.

a. Explain *where* (e.g., from what sources) you would have obtained the following data:

- (1) That no saving in labor overhead (burden) will result from the new installation.
- (2) That there will be no saving through increased production.
- (3) That the scrap value of the old system is the same as its unamortized value.
- (4) That the new system will be used for full normal time operation.
- (5) That $T_b = \text{zero}$.
- (6) That $\$40 = \text{yearly cost of power and supplies}$.
- (7) That $6 = \text{the percentage to be realized on the investment}$.
- (8) That $\$1,000 = \text{the appraised value for taxing purposes}$.
- (9) That $2 = \text{the percentage allowed to provide for insurance}$.
- (10) That $\$1,500 = \text{the appraised value for insurance}$.
- (11) That $10 = \text{the percentage for depreciation}$.
- (12) That $10 = \text{the percentage for upkeep}$.
- (13) That $\$1,618 = \text{the total cost of the new equipment including installation and auxiliary equipment}$.
- (14) That $7 = \text{the number of employees}$.
- (15) That $\$600 = \text{the annual labor saving}$.

b. What are the annual fixed charges on the new equipment?

- c. Find the maximum investment justified by the debit and credit factors given?
- d. What yearly profit do you expect from operation of the new system?
- e. In how many years could you pay for the new system?

Power, Heating, and Air Conditioning

11. Report on the details of a new (a) power, (b) heating, or (c) air-conditioning installation in a company.
12. Report on the best type of (a) power, (b) heating, or (c) air-conditioning equipment for a particular company.

SELECTED REFERENCES

PLANT LOCATION, LAYOUT, AND CONSTRUCTION

See the sections in the general references at the end of Chapter I on this subject, and other subjects in this chapter for which selected references are not given. Also references in special assignments 6 and 7.

PURCHASING

- (1) E. T. GUSHEE and L. F. BOFFEY. *Scientific Purchasing*. New York: McGraw-Hill Book Co. 1928.
- (2) NORMAN F. HARRIMAN. *Principles of Scientific Purchasing*. New York: McGraw-Hill Book Co. 1928.
- (3) H. T. LEWIS. *Industrial Purchasing*. New York: Prentice-Hall. 1933.
- (4) NATIONAL ASSOCIATION OF PURCHASING AGENTS. *Purchasing—An Outline of Essentials and Methods*. New York: 11 Park Place. 1930.

MATERIALS HANDLING

- (5) S. J. KOSHKIN. *Modern Material Handling*. New York: John Wiley & Sons. 1932.

MACHINERY AND EQUIPMENT

- (6) PAUL T. NORTON, JR. *The Selection and Replacement of Manufacturing Equipment*. Blacksburg, Va.: Virginia Polytechnic Institute. Vol. XXVII. No. 11. September, 1934. 35 pp.
- (7) J. W. ROE and C. W. LYTLE. *Factory Equipment*. Scranton, Pa.: International Textbook Co. 1935.

LIGHTING

- (8) M. LUCKIESH and F. K. MOSS. *Seeing—A Partnership of Lighting and Vision*. Baltimore: Williams & Wilkins Co. 1931.
- (9) M. LUCKIESH and F. K. MOSS. *The New Science of Lighting*. Cleveland: General Electric Co., Nela Park Engineering Dept. 1934. 36 pp. (References on pages 35 and 36 of this pamphlet are especially recommended.)

HEATING AND AIR CONDITIONING

- (10) AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. *Guide*. New York: 51 Madison Ave. 1933, 1934, 1935, etc.
- (11) J. A. MOYER and R. U. FITZ. *Air Conditioning*. New York: McGraw-Hill Book Co. 1933.
- (12) O. C. OTT. *The Essential Features of Comfort Air Conditioning*. Los Angeles: John B. Reeves. 44 pp.

POWER

- (13) *Factory Management and Maintenance*. References to "Selected Factory Articles on Power Problems." Vol. 93. No. 10. October, 1935. P. S-132.

WASTE

- (14) AMERICAN ENGINEERING COUNCIL. *Waste In Industry*. New York: McGraw-Hill Book Co. 1921.

CHAPTER VII

MANUFACTURING

Manufacturing involves the control of production from the raw material to the finished stock by the best and cheapest method, so that the product will be of the best quality and delivered at the required time. It is the determination of what shall be produced, and how, when, where, and why it shall be produced. It is production that adds value to the material manufactured, and is the wealth-producing process of industry.

The scientific control of manufacturing or production endeavors to prevent difficulties by setting and maintaining standards of production. It is based on recorded data and facts rather than empirical personal opinion. Manufacturing or production control involves the following functions:

1. Issuance of orders.
2. Planning, designing, and engineering.
3. Routing.
4. Scheduling.
5. Dispatching.
6. Inspection.

The White Sewing Machine Company¹ combines under its production control department the following functions:

Planning.	Cost.
Scheduling.	Purchasing.
Dispatching.	Supplies, raw material, and finished
Time keeping.	parts stock rooms, and receiving.
Pay roll.	

The methods of controlling manufacturing will depend upon the manufacturing processes. For example, if the material flows continuously from the raw material at one end of the factory to the finished stock at the other end, the manufacturing will involve a regular sequence of operations. If the industry is a job-

¹ Oscar Grothe (Vice-President, White Sewing Machine Co.). *Control Points in Manufacturing Expenditures*. New York: American Management Assoc. Production Executives' Series No. 56. 1927. P. 7.

order manufacturing concern where each order involves different processes, the control of manufacturing may be more complicated and necessitate a change of procedure with each job order. Often industries have both types of production. For example, a concern may have the same general type of product produced in a continuous flow of production, but with slight variations adapted to the demands of different customers.

In some companies the production planning is done by a committee composed of the heads of the various functional departments. For example, in one plant of the American Steel Foundries in the Calumet district of Indiana, which employs about 450 men, a planning committee composed of six members meets daily at eleven o'clock to do the planning for the manufacturing. The committee consists of the following members: (1) the chief mechanical engineer, chairman; (2) superintendent of the forging department; (3) superintendent of the spring department; (4) foreman of tools and dies; (5) assistant to the works manager; and (6) special engineer, secretary.

This committee discusses the best methods, materials, and machines to be used on each job in order to effect the lowest possible cost and attain the best quality. The chairman is responsible for all recommendations made and for the fulfillment of those recommendations. The other members are responsible for their particular divisions of the planning which is decided upon at the daily meeting of the planning committee. In addition to the planning, the dispatching is delegated through this committee.

Whatever the type of manufacturing process, or the size of the company, production control usually involves issuance of orders, planning, routing, scheduling, dispatching, and inspection.

ISSUANCE OF ORDERS

The manufacturing process starts with an order to manufacture from the president or the manufacturing executive of the company. In the job-order concern it may result from a sales order. In a company manufacturing the same type of products continuously it may be the result of a sales estimate made by the chief executive.

The manufacturing orders are, in turn, broken down into production orders for each product, into work orders for each part, into operation orders for each operation on each part. The

operation and work orders set the manufacturing process in motion and form the basis for the issuance of material, instructions for performing the work, the authorization of the worker to produce, and the inspection and moving of the material worked upon. However, before these work orders can be issued, the production must be planned, the product must be designed, and the engineering work must be performed.

PLANNING AND ENGINEERING

Planning is the most important part of the manufacturing. It involves thinking through the whole production process from beginning to end for the required quality and quantity at the proper time and by the best and most economical method. Before the production is actually begun the whole manufacturing process is gone through. Methods, materials, machines, and men to be employed in the production process are considered in advance. Planning endeavors to solve the problems of design and engineering, routing, scheduling, and inspection before the production difficulties occur.

There are two general phases of the management of manufacturing or production control—the first, that of planning, and second, that of carrying out what has been planned. The first phase involves the design and engineering of the product, such as the preparation of drawings and blueprints, tools, jigs, and fixtures, the material to be used and the specifications for this material, the collection of data on present and new machinery needed, the determination of feeds, speeds, power, times and costs, capacities, stores, inspection methods, and wage incentive methods. A centralized engineering department usually makes the design and does the engineering work involved in the manufacturing procedure. Examples of these departmental divisions are to be found in the Procter and Gamble Company, Delco-Remy Corporation, and Leeds and Northrup Company.

The Procter and Gamble Company has the following departments in its engineering division: (1) the construction department, consisting of design and drafting, construction, and appraisal and records; (2) heat and power department, consisting of steam, power, refrigeration, and drafting sections; (3) mechanical development department, consisting of material standards, automatic machinery, and process engineering sections; and (4) an engineering department for a separate plant.

The engineering department of the Delco-Remy Corporation consists of (1) the model shop, (2) engineering laboratory, (3) engineering design, (4) drafting and blueprinting, (5) and a special product (Horn) laboratory.

The engineering department of the Leeds and Northrup Company maintains the following activities:¹

- a. The preparation of designs, drawings, specifications, and bills of material for regular and special products.
- b. Seeing that each production order going into the shop is accompanied with the proper drawings, specifications, etc.
- c. Estimating costs upon special apparatus.
- d. Preparation of directions.
- e. Continual scanning of designs with the view to improvement from the standpoint of quality or cost of production, or both.
- f. Consultation with the sales department concerning customers' requirements.
- g. The development of new lines of products.
- h. Patent activities.
- i. What is commonly termed pure research work—that type of research work which does not necessarily have any immediate practical application but which results in spreading the bounds of human knowledge.

From these we might define, generally, the functions of the engineering department as (1) designing, drafting, and blueprinting, (2) setting standards and preparing specifications, (3) providing tools and machinery, (4) construction, (5) heat, power, and light, (6) research, and (7) testing and inspection.

Another general definition of engineering may be obtained from the various subjects taught in a high-grade engineering college or university.

When the design and engineering work with the drawings, tools, machine capacities, work instructions, and the other engineering methods of manufacturing are completed, the planning can then proceed towards the coordination of the various factors of production control. Figure 52 shows the factors entering into production control in the Ross Gear and Tool Company, from the time the raw material enters the plant until it is shipped.

From the individual production control plans, Dean Kimball has diagrammed manufacturing procedure in general, as shown

¹ C. S. Redding, "Research and Development Departments: Their Function, Activities, and Relation to Other Departments." *Research and Development Departments*. Production Executive Series: No. 78. New York: American Management Association. 1929. Pp. 4-5.

in Fig. 53, to comprise planning, engineering, routing, dispatching, and inspection.

Before the general procedure can be started, however, it is necessary to know the exact amounts of the product or products to be manufactured. Sometimes these amounts to be manufactured are stated on the executive production orders, but if large quantities are to be produced it may be economical to break down

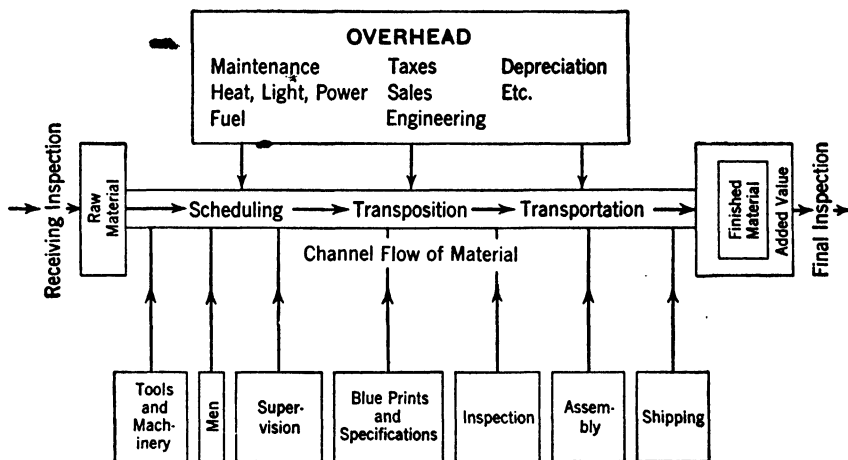


FIG. 52.—Chart of planning production control. (Prepared by W. K. Creson, Chief Engineer, Ross Gear and Tool Company, Lafayette, Indiana. 1935.)

the mass production into the most economical lot sizes of manufacture. In recent years much discussion and many calculations of the most economical lot sizes to manufacture have been carried on. Formulas have even been developed for calculating the proper quantities. An excellent one was developed by Professor Norton as follows:

FORMULA FOR CALCULATING ECONOMIC LOT SIZES IN MANUFACTURING¹

Q = the lot size (pieces per lot).

Q_e = the economic lot size (pieces per lot).

S = total preparation cost per lot (dollars), including cost of preparing manufacturing orders, cost of setting up

¹ Paul T. Norton, Jr. *Mechanical Engineering*. October, 1933. Pp. 608-9.

See also Paul T. Norton, Jr., "Economic Lot Sizes in Manufacturing," Blacksburg, Va., *Bulletin of the Virginia Polytechnic Institute*, Vol. XXVII, No. 6, April, 1934.

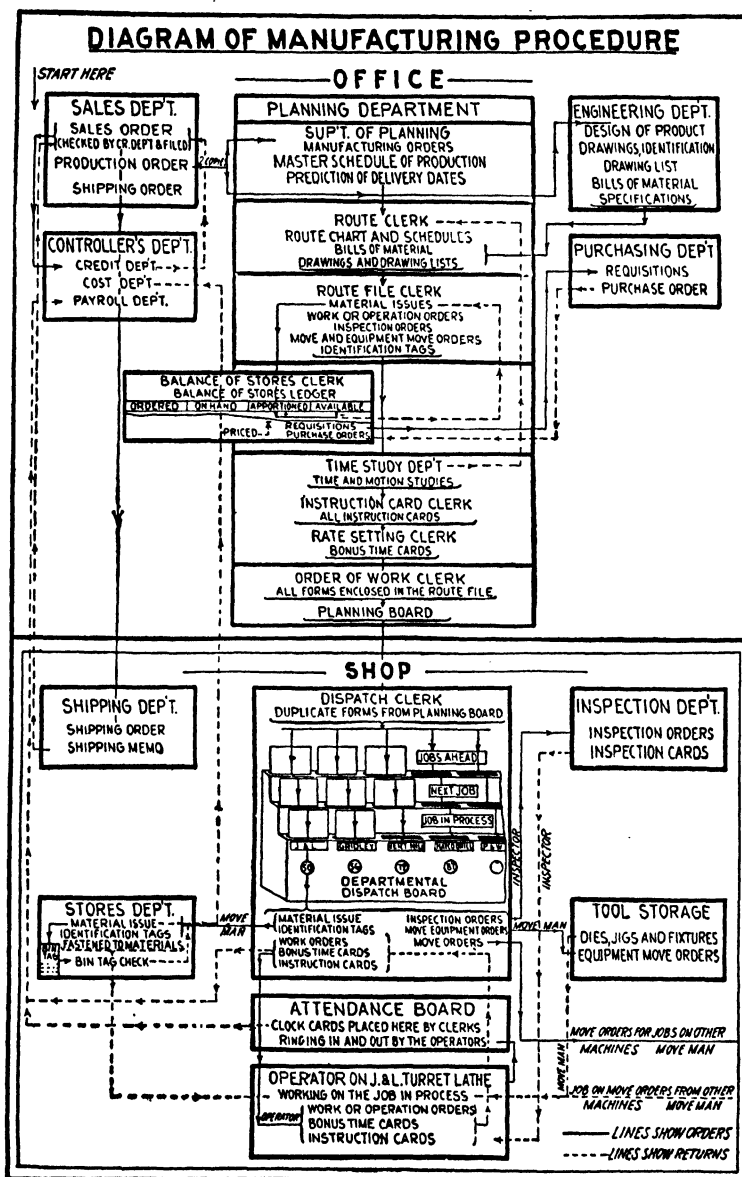


FIG. 53.—Diagram of manufacturing procedure. (D. S. Kimball. *Principles of Industrial Organization*. New York: McGraw-Hill Book Co. 1933, P. 2-5. Devised by Prof. J. R. Bangs, Cornell University.)

machines, and any similar costs that are independent of the number of pieces in the lot.

P = pieces made per day.

U = pieces used per day.

N = days worked per year.

C = material, direct labor, and overhead per piece, dollars.

A = cost of storing one piece for one year, dollars.

B = taxes, insurance, etc., per cent per year on inventory.

I = desired return on capital, per cent per year.

V = total amount charged against each piece: (a) for preparation costs, including costs in production control department as well as cost of machine set-ups; (b) for material, direct labor, and factory overhead; and (c) for storage charges, including desired return on capital.

"For the sake of simplicity we shall neglect the preparation cost per piece in figuring the capital tied up in inventory. We shall also assume that the total amount per piece for material, direct labor, and factory overhead C will be charged from the time that production begins. The errors due to these assumptions will be minor in most cases and it will be noted that they tend to cancel each other. After the lot size has been determined under these assumptions, it is a very simple matter to establish the relationship between the various unit costs for the lot size that has been decided upon and to adjust the lot size, although such adjustment will rarely be necessary.

"It is customary in analyses of this sort to assume that the consumption rate will be uniform, in which case the average time that any piece is tied up in production and storage will be $Q/2U$ days, or $Q/2NU$ years. If the demand is markedly seasonal and the amount of capital tied up in inventory is considerable, it may be desirable to manufacture in lots of different size during different seasons. The proper lot size for each season may be determined by simply using the proper consumption rate.

$$\text{Unit cost for taxes, insurance, etc.,} = \frac{BCQ}{2NU} \quad (1)$$

$$\text{Unit charge for return on capital} = \frac{ICQ}{2NU} \quad (2)$$

$$\text{Unit cost of storage space} = \frac{A\left(1 - \frac{U}{P}\right)Q}{NU} \quad (3)$$

"It is assumed that storage space must be provided for the maximum number to be placed in storage for lot Q . The fraction of the lot that goes in storage is $(P - U)/P$.

"Where P is very large in comparison with U , the number for which storage must be provided is practically Q .

"The total charges per piece, incident to storage, are the sum of (1), (2), and (3), and may be written

$$\left[\frac{(B + I)C + 2A\left(1 - \frac{U}{P}\right)}{2NU} \right] Q = KQ \quad (4)$$

"The total charges against each piece will be

$$V = \frac{S}{Q} + C + KQ \quad (5)$$

$$\frac{dV}{dQ} = -\frac{S}{Q^2} + 0 + K \quad (6)$$

V will be a minimum when $\frac{dV}{dQ} = 0$, and therefore the lot size for minimum V may be found from the formula

$$Q_0 = \sqrt{\frac{S}{K}} \quad (7)$$

"This simple formula is quite similar in appearance to many economic lot size formulas that have been developed in the past, but as will be shown presently, it includes important factors that are ordinarily neglected.

Formula (7) may be written:

$$\frac{S}{Q_0} = KQ_0 \quad (8)$$

"This shows that, for the economic lot size, the unit preparation charges are equal to the unit charges incident to storage. This relationship is useful where it is desired to solve a problem of this sort by cut-and-try or graphical methods.

"While the approximately constant unit cost of material, direct labor, and factory overhead C does not appear directly in the final formula, it does affect the economic lot size because K is a function of C ."

In considering economical lot sizes in general, diminishing returns may result from a continued increase in the lot size. As

a simple example, if the cost of material per piece is 50 cents, the cost of labor—50 cents, the cost to set up the machine to produce it is \$5.00, then the cost to manufacture one piece on that machine would be $\$0.50 + \$0.50 + \$5.00 = \$6.00$ per piece.

10 pieces would cost $10 \times \$0.50 + 10 \times \$0.50 + \$5.00 = \$15.00$ or \$1.50 per piece.

100 pieces would cost $100 \times \$0.50 + 100 \times \$0.50 + \$5.00 = \$105.00$ or \$1.05 per piece.

1,000 pieces would cost $1,000 \times \$0.50 + 1,000 \times \$0.50 + \$5.00 = \$1,005.00$ or \$1.005 per piece.

10,000 pieces would cost $10,000 \times \$0.50 + 10,000 \times \$0.50 + \$5.00 = \$10,005.00$ or \$1.0005 per piece.

In the cases of the quantities of 1,000 and 10,000 pieces, the cost per piece in 1,000 lots is but little different from that of producing 10,000, and probably not great enough to effect a lower price on the product. If the cost of the machine is considered, a point will be reached where an increase in the number manufactured will not materially decrease the unit cost of production, because the fixed costs may prevent a lower unit cost. There will then be a diminishing return with the increase of production. Sometimes the added return may even be less than the added overhead to actualize the added return. Nevertheless, the idea of diminishing returns should be carefully considered in every calculation of the economical lot size of manufacture.

ROUTING

After the production has been planned, the engineering performed, and the most economical lot sizes selected, each part of each product must be routed through the plant. The various operations on each part are determined and the best and cheapest sequence is selected. In order to accomplish this, the capacities of each machine must be known. Then the machines should be placed so that the best sequence of operations results, or the operations routed to the machines in the most economical manner, depending upon whether the machine layout of the plant is for straight-line production or by functions.

The routings of operations and parts are made so that each part will be ready for its assembly or sub-assembly at the proper time. Some companies have a progressive assembly with sub-

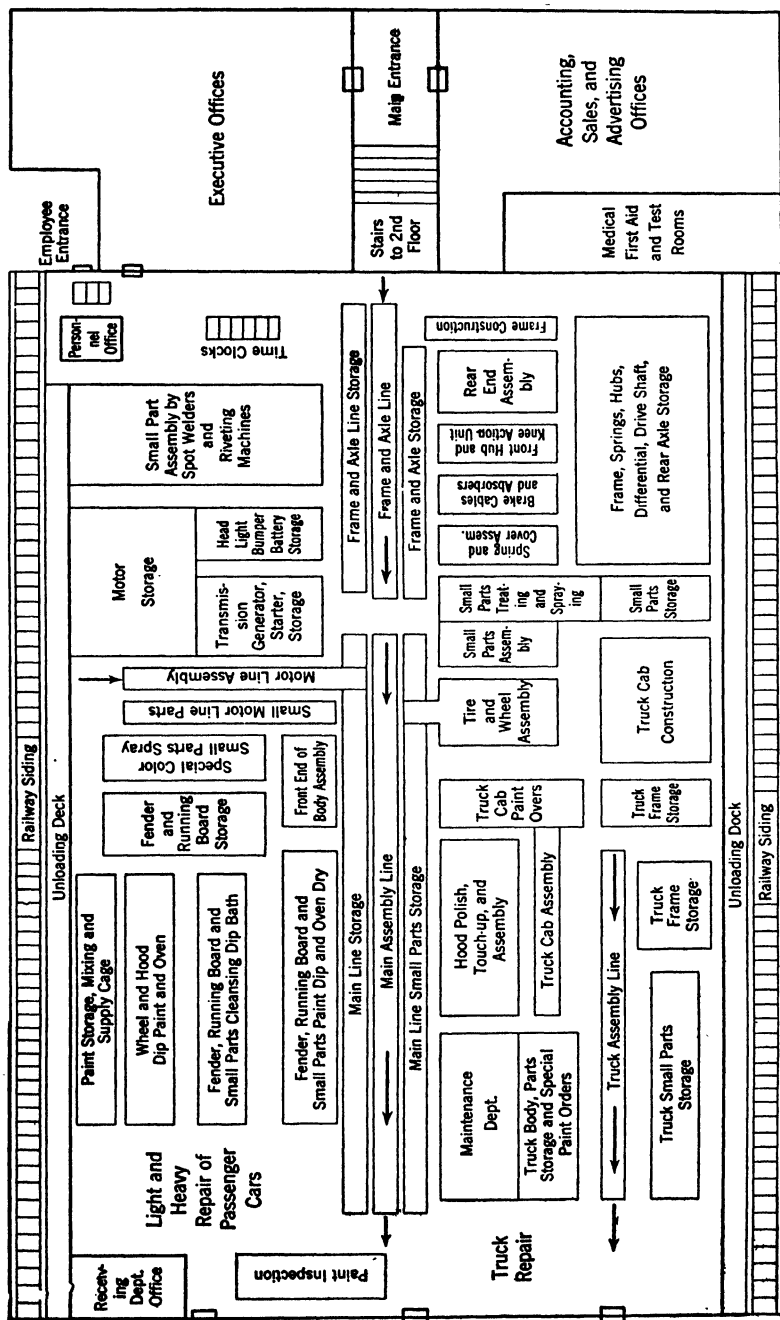


FIG. 54.—Routing layout of the Chevrolet Motor Company, Baltimore, Maryland.

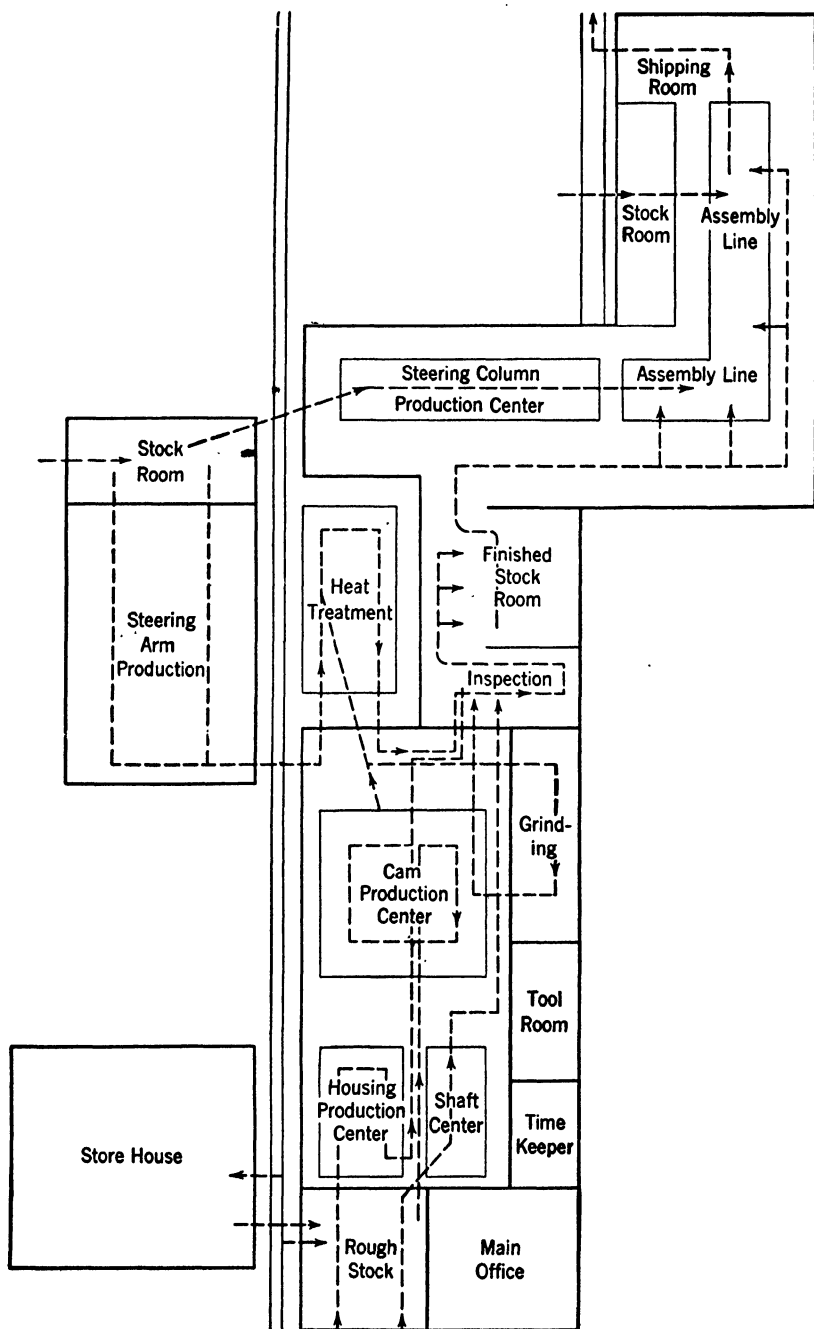


FIG. 55.—Chart of the flow of material through the plant of the Ross Gear and Tool Company, Lafayette, Indiana.

production lines and assemblies leading into the progressive assembly, such as those shown in the Chevrolet Plant in Fig. 54.

Other companies first prepare a general routing which the different models of the same or similar products are to take. Such a routing for the Ross Gear and Tool Company is shown in Fig. 55.

The Chevrolet and Ross Gear and Tool Company routings emphasize that adequate layout, discussed in the previous chapter, is essential to economical routing.

Routing shows the path which the products are to take. But after the path has been designated it is necessary to schedule the times when each operation on each part shall be performed. This is scheduling in the manufacturing procedure.

SCHEDULING

Routing is the designation of where the work is to be done. Scheduling is the determination of when the work is to be performed on each part of each assembly of each model of each product. This is accomplished by means of a master schedule, a part schedule, and an operation schedule. The master schedule is a composite schedule of the work of the whole plant; it is broken down into its different departments, with a schedule of each job and each operation so that each part will be finished at the proper time for sub-assembly, and each sub-assembly finished at the correct time for final assembly. This process is shown graphically in Fig. 56 for a typical product carried out by the detailed operations, the parts, the sub-assemblies, and final assembly.

In recent years some companies have used a method of scheduling each operation or all operations so that they will be completed or meet the final assembly of the parts at the latest possible time and yet be on schedule, rather than performing the operation or making the part and storing it for the final assembly. This process of delaying the operation until the last possible time prevents storage of the product from the time it is finished until it is assembled. It saves on the investment involved in storage because the material is not purchased until the operations are ready to be performed on the material. Also it keeps the department or person doing the job or operation alert and producing exactly on schedule.

If there is a delay in the assembly caused by the delay of one

part, some companies consider it a fault of the management. If continued delays occur in furnishing a part for an assembly, the work of the department or person performing the operations is investigated and the difficulty corrected. This keeps the management of that department operating efficiently.

The difference between the method of producing each part or performing each operation as soon as possible after the order is placed and the new method of delaying each operation or part

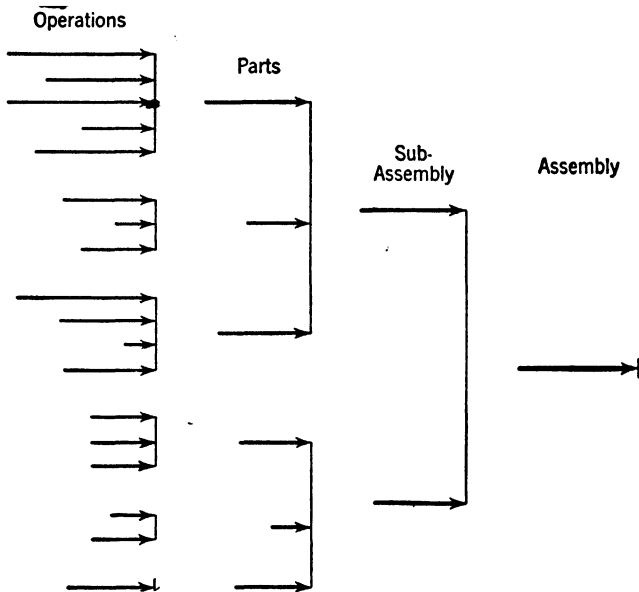


FIG. 56.—Chart showing a sequence of scheduling production.

as long as possible, may be shown diagrammatically as in Fig. 57, *a*—the old method, and *b*—the new procedure.

After the production schedule has been made it is necessary to control production according to that schedule. A greatly used tool of management for controlling production is the *Gantt chart*, which was first developed by the late H. L. Gantt, the prominent industrial and management engineer. Figure 58 *a* and *b* shows Gantt man record and machine record charts. After each man's name on the chart there is a codified diagram representing the amount of work a man should do or should have done, the estimated time for the work done, the cumulative time, etc., as shown on the diagram. From a comparison of the work

actually done to what should have been done, the idle time of each man can easily be determined and visually seen from the chart with the reason for the idleness or lost time. A total can then be made for a department from the records of the different individuals in the department and the work done can be compared with what should have been done. The foreman or supervisor can be held responsible for the idle time in his department. A master schedule can be made showing the work of each department and the entire company. Interdepartmental comparisons can be made from the master chart.

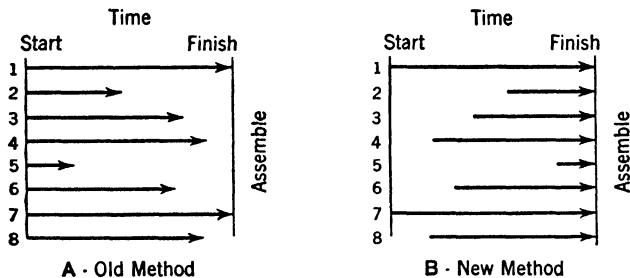


FIG. 57.—Chart showing two plans of scheduling production of eight parts of an assembly.

A machine record chart can be maintained for each machine showing the work capacity of the machine and the work that was actually performed on it. Mr. Gantt made out periodic idleness reports for both men and machines. The Gantt charts have been found to be an excellent means of controlling production. Many companies control production just by means of figures without charting the results for a visual record.

The Gantt chart has been adapted not only to the fields of production control but also to sales and various other types of business and industrial activities where a comparison of the work accomplished and the work which should have been done is desirable.

Some companies have devised what is often called a control board for maintaining and visualizing their master schedule. This control board contains a number of horizontal rows, one for each machine or job with the space after each machine or job divided into columns of days or periods of work. Below each the exact work that should be performed on that machine at that particular time is posted after each machine. The visual

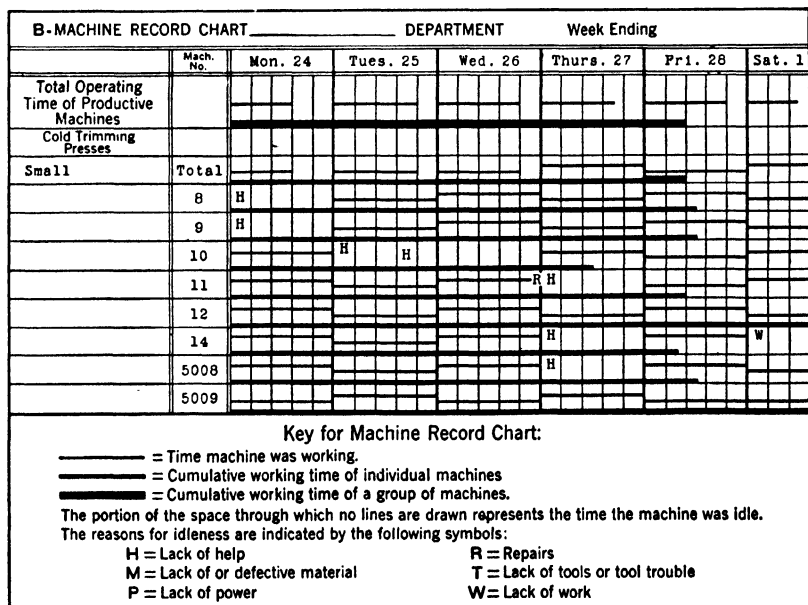
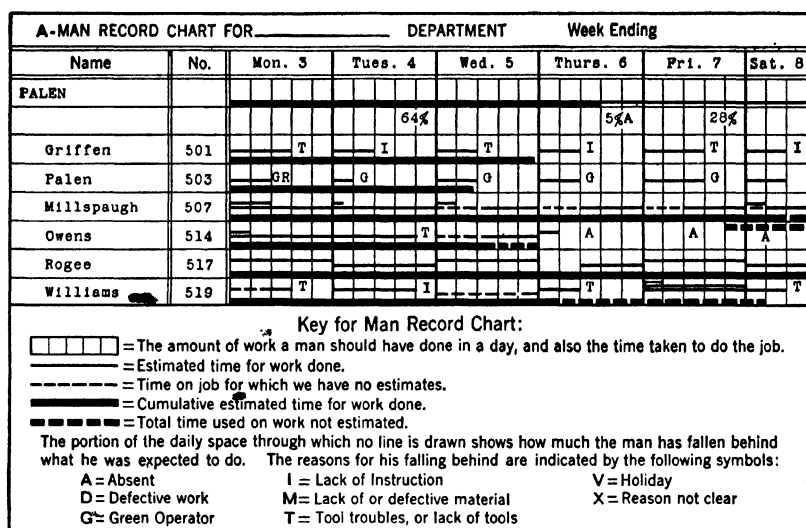


FIG. 58.—Gantt Charts. (From: Gantt, H. L., *Organization for Work*. New York: Harcourt, Brace and Howe. 1919. 115 pages. Also see Wallace Clark, *The Gantt Chart*.)

check is maintained to show what was actually performed and to show delays, idleness times, and losses.

After the schedule has been made and the control board set up it is necessary to follow through and dispatch the work as scheduled.

DISPATCHING

The dispatching of work involves (1) the issuance of instructions, blueprints, and orders to perform the work; (2) authorizations for the issuance of material, tools, jigs, and fixtures; (3) the recording of times of starting and completions of operations, jobs, and products; (4) keeping the work in process and

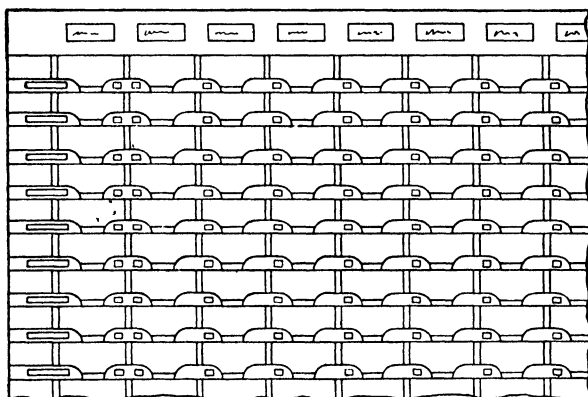


FIG. 59.—Diagram of dispatch rack for tabulating machine cards.

seeing that materials are moved from one job to another; (5) adjustments of schedules to keep each person working and each machine in operation. It is necessary to have dispatched at all times sufficient work for each man to maintain a continuous uninterrupted performance of his work. The typical method of doing this is to keep each worker supplied with orders, instructions, blueprints, etc., for (1) the job in process, (2) the next job, and (3) jobs ahead. Often a rack with three sections for these three divisions of work is maintained where at all times the orders and instructions for each worker's present job, next job, and jobs ahead are available. Efficient management always plans and dispatches enough work to keep each man continually busy.

Some companies combine the control board and the dispatch-

ing rack, and orders in the form of tabulating machine cards are issued for each job or each operation, the cards being put in order of desired performance and under the desired date on the control-dispatch board. Figure 59 is a diagram of a section of the control-dispatch board of one plant, and Fig. 60 shows the Hollerith job card used as an order in dispatching the work. Times of starting and completing the work are recorded and tabulated quickly by machine for labor and other costs, as well as information which the management can use in controlling manufacturing.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2
1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
PROD. CTR. USED		PCS. REQUIRED		STD. PTS. OR TIME		PIECE NO.		PIECE NAME										1													
																		2													
																		3													
AMOUNT		PCS. DONE		POINTS		DRAWING NO.		OPERATION NAME OR DESCRIPTION OF WORK										4													
																		5													
																		6													
PROD. CTR. SERVED		BAL. REQUIRED		GANG LEADER		UNIT REPAIRED												7													
																		8													
																		9													
																		10													
		FIN.				ACCOUNT NO.		OPERATION NO.		RACK NO.		DIE OR JIG NO.		ORDER NO.																	
		START																													
		TIME				L/O OR S/A NO.		NEXT OPERATION				NEXT RACK																			
MAN HOURS		CLASS NO		UNIT USED																											
								ISSUED BY		CLERK		FOREMAN																			

FIG. 60.—Tabulating machine card used as a job order.

Though the manufacturing may be planned, routed, scheduled, and dispatched adequately there must be a check upon the quality of the product. Modern management inspects its products so that they will be of the desired quality and will not be returned.

INSPECTION

Inspection involves the control of the quality of the product. Though the engineering department designs and lays out the product and the production department produces it, the inspection department determines whether they have engineered and produced it of the required quality. Inspection is judicial in its nature, because it signifies to the engineering and production departments whether they have produced a product which meets the specification standards and required quality. Its object is to discover in advance, if possible, any errors in workmanship that

will prevent the product from becoming a finished unit, as well as to discover any imperfect work after completion.

The typical inspection department verifies all purchased parts and designs, makes and repairs the gauges, and checks the various tolerances allowed. The principal function is that of checking by inspection to see whether the products manufactured meet the designs and specifications for those products, and finally that of inspecting the finished product to see that it meets the customer's order and operation efficiency.

Many methods of inspection now exist. Some companies select a sample of the production instead of inspecting all of it. Some companies inspect the first and last pieces produced. Various ways¹ have been used for the selection of the quantities and products to be inspected.

Besides the sampling methods it is necessary for some companies to inspect every product which they produce or every process performed. For example, the boiler companies are required to X-ray every boiler weld, and guarantee by means of X-ray photographs that certain specifications have been met.

Whether inspection is done on a sample or on all of the products the end result is to guarantee to the management that the quality of the product is that specified by the customer or by the management itself. An example of an excellent inspection department is that of the Delco-Remy Corporation, which has been described by Mr. W. F. Kimball² as follows:

It is the Inspection Department's duty to see that all material, parts, and assemblies are either purchased or manufactured by the various plants, to conform to the specifications and blueprints furnished by the Engineering Department; to keep in close touch with all of the manufacturing departments, to inspect and advise them as to how the parts are conforming to these specifications so that scrapped parts and labor might be held to minimum; to test the equipment, after it is assembled, to the proper test specification; to call upon the companies using our equipment and report any trouble that may occur or any condition in these plants which might be a detriment to our equipment; and to report the proper count of good parts or units to the Cost Department so that employees can be paid.

In looking over the organization chart of our company, we find the Chief Inspector reporting directly to the General Manager, thus establishing this Department as a separate organization, however, working parallel with the

¹See W. A. Shewhart, *The Economic Control of Quality of Manufactured Product*, New York, D. Van Nostrand Co., 1931.

²Prepared for the author by W. F. Kimball, Inspection Department, Delco-Remy Division, General Motors Corp., Anderson, Ind., 1935.

Engineering and Production Departments. In some industries, Inspection is united with Service, Engineering or the Factory Manager. It depends largely on the ability of the Chief Inspector as to whom he shall report or to the extent of his duties.

In outlining the organization under the Chief Inspector, the best results have been obtained by the so-called line and staff organization. This consists of the Supervisors of Inspection in each plant and their assistants, foremen, inspectors and group leader-inspectors. This makes up the chain of command through whom instructions pass from the Chief Inspector to the individual inspector at the bench. The staff organization consists of the office force who help the Chief Inspector in the pursuit of his duties, and the traveling inspectors who contact the various customers to whom our products are sold.

The responsibility of the Inspection Department comprises a number of things that, strictly speaking, are not entirely inspection, but are related to it and are economically included with Inspection to secure a more complete control of quality. Therefore, under our present set-up it is charged with the responsibility of the following:

1. Receiving inspection on raw materials and purchased parts.
2. Gauge designing, gauge making and repairing.
3. By-products Department.
4. Gauge and Part Checking Department.
5. Final inspection.

It is the duty of the Receiving Inspection Department to receive and check, for physical and chemical properties, all material and parts purchased by the Corporation. Should the material not meet the specifications as specified by the Engineering Department, it is rejected and held for instructions from the purveyor, these being obtained through the Purchasing Department.

Inspection has a gauge design and a gauge manufacturing department. After a new product or part is designed by the Engineering Department, the Inspection Gauge Design Department immediately designs the necessary fixtures and gauges and has them manufactured so that they will be ready for use when Production has the parts finished. In some organizations, this work is done by the Tool Division. The reason for separating these phases is that one serves as a check upon the other. The Tool Division designs the proper tools for Production, and Inspection designs the proper gauges to check these tools. Also Inspection assumes the responsibility for the proper setting of the gauges used by Inspection and of those used by Production.

The By-products or Salvage Department is controlled by Inspection. It is to this department that all defective material is returned from the plants for salvage credit to the company. Also, all units or parts found defective in the field or at the customer's plants are returned through this department and the credit or debit is made to the proper party. The point to keep in mind is that all parts returned, either defective or for observation, are cleared through this department. It is through this method that all defective material is kept from the regular production flow.

It is the Salvage Department's duty to check all defective material received, as to its salvage value. This material is either reoperated, reclaimed or sold for scrap. Should any of the units or parts returned be of salvage worth they are sent to the departments in which they were made and the good parts

reinstated into the Production flow, the credit for these parts being given to the account under which the units or parts were returned.

It is very imperative that all new parts be submitted to Inspection for check before the job is run. This is done so that in case tools are defective, defective parts will not be made. This is just one of the many precautions taken by the Inspection Department in the further control of scrap. Likewise, all new units are checked for mechanical dimensions according to the blueprint in order that the unit will fit in the place designed for it by the customer. Such dimensions are usually called "Customer's Mounting."

It is imperative that parts assembled by our customers be given a closer inspection than parts assembled in our plant. This must be done, because the customer pays only for good pieces, and parts must assemble with the least amount of trouble. Parts assembled by ourselves which might not be according to specifications can be reoperated easily or adjustments made, to correct for the trouble. In a number of cases, where parts are not inspected before assembly, the defective parts are caught in the assembling process. The cost involved in this procedure is less, in some cases, than the inspection cost.

After the parts have passed inspection in the respective parts-making department and have been issued to the assembling department, it may be assumed with reasonable assurance that they can be assembled satisfactorily. There is a tendency, however, for parts to be passed from the parts-making departments which do not quite meet up to the standards outlined by the Engineering Department. The quality of these parts slips away from the desired standards so gradually that they are hard to detect in these departments.

For this reason, a final inspection is made on these parts after they have been assembled in the Final Assembly Department.

Usually this reinspection may seem unwarranted; however, should trouble be encountered in the Assembly Department, the Final Inspection will have the parts checked and the information passed directly and speedily back to the department manufacturing the part. It is in this manner that the Final Inspection obtains information of value for the entire shop.

It is the duty of the Final Inspection to test and measure all parts and units to the specifications given by the Engineering Department and in most cases to pack the products suitable for shipment to the customer.

PRODUCTION CONTROL DIVISION OF THE SERVEL COMPANY

In order to exemplify some of the principles of the management of manufacturing and production control discussed in this chapter, a description of the production methods of the Servel Company follows:

PRODUCTION CONTROL DIVISION OF SERVEL, INC.¹

Functions

(a) To provide materials for fabricating and assembling schedules—the proper kind, the proper quantity, and at the proper time.

¹Prepared by Fred T. Creech, Superintendent, Production Control Division, Servel, Inc., Evansville, Ind., 1936.

(b) To store productive materials and feed to fabricating and assembling departments as required.

(c) To schedule and follow up the production of each fabricating and assembling department to the end that the finished product is available in kind and quantity to fill promptly all sales requirements.

(d) To move all material between departments and plants in the course of fabricating and assembling.

(e) To store the finished product and ship it in accordance with sales orders.

(f) To furnish Traffic Service in routeing shipments, quoting tariffs, filing claims for overcharge and damages, and tracing inbound and outbound shipments.

Organization

So that a particular individual can be held responsible for the fulfillment of each function of the Production Control Division, the division is divided into six functional groups or departments:

Group "A" is the Materials Control Dept., which is responsible for the acquisition of material.

Group "B" is the Stores Dept. and Lumber Yard, which stores material and delivers as required.

Group "C" is the Dispatch Dept., which schedules, follows up, and co-ordinates the manufacturing activities of all productive departments.

Group "D" is the Motor Transport Dept., which with motor trucks, tractors, trailers, electric lift, and hand trucks moves all material between departments and plants.

Group "E" is the Shipping Dept.

Group "F" is the Traffic Dept.

Methods

The first step in the control of materials is the determination of usage or in other words "how much of this or that kind of material" is required to build a refrigerator.

The determination of material usage per job is the function of the specifications section of the Materials Control Dept. This information is derived from Bills of Material prepared and published by the Engineering Dept., from part blueprints from which stock per piece, blank sizes, etc., are taken, and sometimes by actual experience in the shop, using monthly consumption, test runs, etc.

It is necessary to compile this information but once, i.e., when the model is released by the Engineering Dept. and revised thereafter only when changes in design are made by the Engineering Dept.

The material usage (stock per piece and pieces per job) is then posted by the Materials Control Clerks to their stock record cards.

The Master Manufacturing Schedule covering the quantities and models to be built each month is issued to Production Control Division by the Budget Dept. after consultation with the Sales Manager and the President. Seventy days is allowed between date of issue and start of finished production.

Upon receipt of the Master Manufacturing Schedule, it is necessary for the Materials Control Clerks to project it into material, raw, semi-finished, and finished in order to determine total requirements. By having usage per job already shown on stock records, this is simply a matter of multiplying total units scheduled by usage per job and adding an allowance for scrap.

Requisitions are then prepared and forwarded to the Purchasing Dept. These requisitions carry a tentative delivery date which is of value to our vendors in procuring their materials and arranging for their own processes.

The control of material is divided into commodities with a man or group of men in charge of each. Following is the present grouping of commodities in the Materials Control Dept.:

1. Tubing.
2. Sheet metal.
3. Bar and strip stock.
4. Lumber.
5. Purchased B/P parts.
6. Standard parts.
7. Bulk materials.
8. Crates and printed matter.

The next step in both Materials and Production Control is the preparation of the Assembly Schedule. The Assembly Schedule is prepared jointly by the Production Control Manager, Supervisor of Materials Control, and Chief Dispatcher and covers the models and quantities released eighteen days prior by the Budget Dept. in the Master Manufacturing Schedule. However, the assembly is broken down into lots of standard runs for the purpose of (1) bringing in material and (2) scheduling lots of parts and sub-assemblies through fabricating departments.

The Assembly Schedules spread the month's requirements of finished product over the final assembly lines at an even rate per day. All other schedules for parts and sub-assemblies, as well as the releasing of material, is predicated on this monthly assembly schedule of finished product.

As soon as it is issued the Materials Control Clerks begin releasing material through the Purchasing Dept. The reverse side of the traveling requisition card is used for this purpose and a definite date on which each lot of material is to be shipped is stated on the releases. In releasing material, in-bound transit time and our own processing time are taken into consideration on each and every lot of material.

However, different classes of material are not released in exactly the same manner. Material is roughly grouped into four classes when being released, viz.:

1. Entire month's supply.
2. Groups.
3. Lots.
4. Days.

In other words, when releasing small inexpensive parts, the entire month's requirements (#1 above) are brought in at one time. This is also true of steel for small punch presses and automatic screw machines where we run our entire month's requirements of one part in one continuous run.

Other items, bulkier and more expensive, are brought in in ten days' supply or groups (#2 above).

Other items which are expensive and tie up considerable money in inventory and also create a storage problem are brought in in lots as required by the fabricating departments. Sheet steel is a good example of this class (#3 above).

Bulky materials, such as insulation, crates, etc., are brought in almost daily (#4 above).

After Materials Control Clerks have given Purchasing Dept. the shipping dates on all material necessary for an assembly schedule, they are not relieved of their responsibility until the material is actually in our possession. In other words, they must, through the follow-up section of the Purchasing Dept., keep themselves informed, and if delays in delivery occur, furnish substitute material or arrange for a change in schedule.

The Materials Control Clerks also prepare fabrication schedules for individual parts to be made in our own shops. They are required to do this as they must show amount and kinds of raw materials to be used.

Actual production of parts, sub-assemblies, and finished product is controlled in the shop by the Dispatch Dept. The finished product assembly schedule is detailed by the Chief Dispatcher who also prepares all other incidental assembly schedules, such as refrigerating units, thermostats, burners, insulation assemblies, etc., all of which are predicated on the finished product assembly schedule.

All parts fabrication schedules are turned over to him by the Materials Control Clerks and he in turn sends them to his departmental dispatchers.

At the time the Detailed Final Assembly schedule is issued to the shop, a schedule of lots is issued. This is merely a letter listing each lot that is to be built during the month, showing lot number, model number, quantity, and date to start on final assembly. Lot numbers are also shown on the face of the assembly schedules.

Dispatchers are able, from the schedule of lots, or the Assembly Schedule, to determine when a part must be produced in their individual departments, because the fabricating schedule on parts which are made out by the Materials Control Clerks, carry the same lot number as the lot number on the Assembly Schedule for which the parts are to be used.

The dispatcher then has a list of parts to be produced in his department and a means of telling when each one is needed. His next step is to transpose the quantities to a spread sheet, placing the items under dates that are satisfactory. In doing this, he considers the processing time on each item and the machine load. It is necessary for him to stagger the items on his spread sheet so that, when several items are run on one machine, he will start the first item early enough to have time to finish the last item by the time it is needed.

After he has planned his schedule, the next step is to find out if the material is available. If not, a shottage report is turned in to the Materials Control Group.

When each part in a primary department is ready to be started, the dispatcher notifies the foreman and stores by means of a starting ticket. If the part he needs is a purchased finished part, he gets it from the storeroom by means of a dispatch sheet.

When parts are completed, group production reports are made out by the Inspectors. The dispatchers post these daily on their spread sheets and show the plus or minus condition on each item. This information indicates the parts that need the most attention.

Dispatchers are required to keep themselves informed on the condition of production on all items. They point out to the foremen the parts that need personal attention.

The follow-up part of dispatching consumes much more time than the planning of the schedules. Dispatchers are responsible for this function, although in most cases there are stockchasers who do the follow-up.

In short, the Dispatch department are the "watch-dogs" of material in process. They plan the schedules, follow up to see that they are enforced, watch to see that material is properly used, see that reports on production, scrap, etc., are properly made; they are responsible for having material at each point when needed and are obliged to have no more than is needed so that material turnover will be as rapid as possible.

SPECIAL ASSIGNMENTS

1. Describe the manufacturing or production control procedure of an individual plant or department of a manufacturing company.
2. Report the details of the procedures of performing the following functions in an individual plant:
 - A. Planning.
 - B. Engineering.
 - C. Routing, scheduling, and dispatching.
 - D. Inspection.
 - E. The determination of the proper economical lot size to manufacture.
3. Report on Selected References 4 (a); 4 (b).

SELECTED REFERENCES

- (1) H. W. BARCLAY. *Ford Production Methods*. New York: Harper & Brothers. 1936.
- (2) W. CLARK. *The Gantt Chart*. New York: Ronald Press Co. 1922.
- (3) H. DIEMER. *Profitable Production Control*. New York: McGraw-Hill Book Co. 1930.
- (4) H. P. DUTTON. (a) "Production Control." *Factory Management and Maintenance*. Vol. 93. No. 6. June, 1935. Pp. S-45-60.
(b) "Quality Control." Vol. 93. No. 9. September, 1935. Pp. S-93-108.
- (5) J. W. HALLOCK. *Production Planning*. New York: Ronald Press Co. 1929.
- (6) W. O. LICHTNER. *Planned Control in Production*. New York: Ronald Press Co. 1924.
- (7) F. E. RAYMOND. *Quantity and Economy in Manufacture*. New York: McGraw-Hill Book Co. 1931.
- (8) W. A. SHEWHART. *Economic Control of Quality of Manufactured Product*. New York: D. Van Nostrand Co. 1931.

CHAPTER VIII

MARKETING

Early industry could sell its products easily. The problem of marketing was not so important to management then as it is today. In 1850, the cost of marketing was only about 20 per cent of the sale price; in 1900, 40 per cent; and today it is estimated generally to cost about 50 per cent of the selling price. As industry grew in this country much attention was paid to production, whereas efficiency in marketing was not similarly investigated. Because production was then the more urgent need of management, greater attention was paid to it than to marketing. As the cost of marketing is equal to the other factors of management, we should apply the scientific method to it as well as to the others. Also, with the growth of industry, the gap between the consumer and the manufacturer has become so great that the present-day management needs to lessen that gap by modern marketing methods.

From the economical point of view, products have a place and time utility. A product must be at the place of demand at the time it is demanded to have its full utility. The fact that the product is at the right place at the right time gives it its time and place utility. It may be necessary then for the modern manager to provide his products at the place where they are demanded and at the time they are demanded, in order to create the place and time utility. Commodities, then, must not only be produced but also transported and sold when and where they are demanded, or a demand must be created for them through advertising. When the modern manager must develop a time and place utility for his product, marketing becomes a very important phase of management.

The subject of marketing can be approached from several standpoints—that of the product, the agency doing the marketing, and the functions involved in marketing. The modern manager may have to consider all these approaches, but because marketing is a function of management let us consider it from

the functional standpoint. The functions of marketing may be considered as: (1) the market analysis, or *consumer research*; (2) selling the product; and (3) advertising and publicity.

MARKET ANALYSIS

With the large gap between the producer and the final consumer, the modern manager finds it difficult to know the consumer's needs, tastes, and desires with reference to his product. Likewise he may not know what the consumer's knowledge of his particular product and service is. The market analysis endeavors to provide this information for the manager.¹

In order to find out marketing facts, what customers want and know with reference to their products, some companies carry on consumer research. The General Motors Corporation has added customer research to their management functions as shown in Fig. 61, given below:

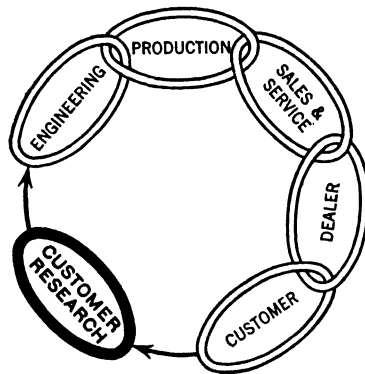


FIG. 61.—Chain chart of the General Motors Corporation's management functions.

In 1933, the staff of the Customer Research Department of General Motors interviewed personally 35,000 motorists, and invited more than 1,400,000 persons to indicate their needs, tastes, and desires with reference to automobiles. The information collected through these interviews and questionnaires was used in the development and sale of the company's products.

In recent years industry in general has been making more of an effort to analyze its markets. The Bureau of Foreign and

¹ See also H. G. Weaver, "Consumer Research and Consumer Education," *Annals of the American Academy of Political and Social Science*, November, 1935.

Domestic Commerce of the United States Department of Commerce recommends that, even before an investment is made in the manufacture of a new product, the marketing, origination, and production factors of the product should be thoroughly studied; the Bureau has provided an excellent check sheet¹ for that purpose, Fig. 62. The same studies and considerations should apply to the study of the marketing of an old product.

In general, a market analysis may be made by the following methods:

1. An investigation of internal company records, census data, and general marketing information.
2. Interviews with customers and consumers.
3. Questionnaires to consumers and customers.
4. Marketing field tests of the product.

In some companies a great deal of valuable marketing information can be obtained from sales records. For example, it may be found that most of the profits of the company are being made by product X, whereas product Y may be being produced at a loss. A detailed analysis of the purchasers and purchases, and the advertising of the products, may show the weak points in the marketing efforts and suggest remedies for the difficulties discovered. A study of marketing costs, product sales, and, in fact, the details of the entire marketing procedure may throw light upon inefficiencies and improve the marketing functions and management in general.

Besides the internal records there are many market research sources,² such as the different departments of federal, state, and local governments, colleges, universities, and federations, publishers of books and trade directories, commercial marketing organizations, advertising agencies, chambers of commerce, and trade associations.

The census of manufacturers and the latest population census figures should throw light upon marketing geography and give to the modern manager a rough survey of his possible markets. The United States Census Bureau divides the United States into nine regional areas: New England States, Central Atlantic,

¹ Bureau of Foreign and Domestic Commerce, United States Department of Commerce. Check Sheet—*Introduction of New Consumer Products*, Market Research Series 7. Washington, D. C. September, 1935.

² See *Market Research Sources*. United States Department of Commerce, Bureau of Finance and Domestic Commerce. Domestic Commerce, Series 55. 1936.

Southwestern, Midwest, Central Northwestern, West Mid-continent, Gulf Southwest, Pacific Northwest, and Pacific Southwest. Increases and decreases in population, land areas, and population per square mile are given not only for the regional areas, but also for each state, county, and city. The wages in these regions, states, counties, and cities can be determined. The different types of occupations, the numbers of persons in them, and various other types of valuable marketing information can be found, from which might be determined the methods of marketing and the amount of marketing effort that should be put forth in different sales areas. It can be very inefficient, from the standpoint of marketing, to put forth the same effort in different localities where the market possibilities are unequal, as shown in Table XIV.

TABLE XIV
DISTRIBUTION OF SALFSMAN'S TIME COMPARED WITH POTENTIAL
INDUSTRIAL MARKET*

Area	Percentage of potential market	Percentage of actual sales- man's time spent in 1932
Cleveland.....	27.5	41.3
Pittsburgh.....	25.2	13.2
Erie.....	11.5	15.1
Youngstown.....	10.1	4.2
Canton.....	9.7	4.9
Akron.....	8.5	11.2
Wheeling.....	7.5	10.1
	100.0	100.0

* E. Hedges, "Market Analysis—An Aid to Profitable Selling." *The Management Review*. March, 1933. P. 73.

In general a study of as many market research sources as practicable is essential to the effective management of marketing.

Some companies use interviews to find the marketing and other facts concerning their products. Interviewers are trained in the methods of making contacts with customers and consumers, and to find out the marketing difficulties, such as trouble with salesmen, weak points in advertising, and the customers' and consumers' viewpoints toward the product.

A sampling of the customers or consumers is made and the trained interviewers are sent to them for the facts about the product. These facts are then analyzed for the improvement of the marketing function. For a product which has been in service

old customers may be interviewed, and for a new product the possible consumers may be selected for interviewing. Usually it is not possible to interview all customers and consumers, so a random sampling is made of the sales field. A small number of interviews selected properly may produce just as good results as a larger number.¹

In recent years many market analyses have been made by means of questionnaires sent by mail to the customers and consumers. A number of types of questionnaires may be used, such as "Yes" and "No" answers to questions, multiple choice, and limited, weighted, or free unrestricted expressions of opinion.

The General Motors Corporation has laid down the following ground rules for framing questions and questionnaires:²

1. We cannot be satisfied in shaping the question merely so that it can be understood. Design it so carefully that it simply cannot be misunderstood.

2. In dealing with technical features, emphasize not the mechanical construction but the effects attained through such construction.

3. Observe the rules of good etiquette, and guard against ballyhoo and insincerity. Be good natured; but avoid being a "smart Alec."

4. Employ phraseology that is common usage with the consumer, even though such phraseology may not represent the best scientific terminology.

5. Remember that we are asking the consumer to do us a favor. Observe the principle of "give and get." Since generally speaking the kind of people to whom we are catering cannot be bought by any pecuniary rewards within our reach, our giving must be in the nature of information or mental satisfaction.

6. Questions regarding any series of items, the answers to which are to be compiled on a relative basis, should be asked the same way.

7. Needless to say, every effort should be put forth to guard against anything that will create a bias in the mind of the buyer.

8. The arrangement or continuity of questions should be such as to facilitate the recipient's flow of thought. People have difficulty in shifting their minds back and forth from one thing to another.

9. To get maximum value out of consumer research findings, it is necessary to ask questions the same way year after year. As a corollary to this, spare no pains to get the questions right—right from the start.

A sample of a questionnaire used by the General Motors Corporation in 1936 is shown in Fig. 63.

Marketing questionnaires are usually sent by mail, but sometimes they are delivered by salesmen and others. Some companies use a section of their advertising space as a questionnaire to

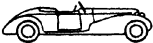
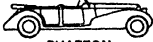
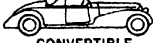
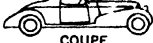
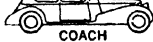
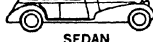
¹ See Psychological Corporation. "How Many Interviews Are Necessary for Results of a Certain Accuracy." New York. 1934.

² H. G. Weaver. *American Marketing Journal*. Vol. I. No. 3. July, 1934. Pp. 116-7.



Make of Car Owned *

Year of Manufacture *

Body Style of your PRESENT Car	CHECK ☐ ANSWER ☐	Body Style Desired on NEXT Car
☐ 		☐
ROADSTER		
☐ 		☐
PHAETON		
☐ 		☐
CONVERTIBLE		
☐ 		☐
COUPE		
☐ 		☐
COACH		
☐ 		☐
SEDAN		

* This information is requested because it will help us in our statistical comparisons.

"Industrial history—in fact CIVILIZATION itself, dates back to the first wheel—the GREATEST, perhaps, of ALL INVENTIONS."

—CHARLES F. KETTERING

What type WHEELS do you prefer?

☐ 	☐ 
Wood	Disc
☐ 	☐ 
Wire	Pressed Steel

REAR CONTOURS

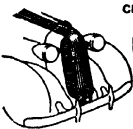
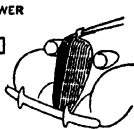
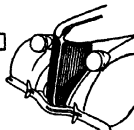
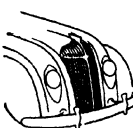
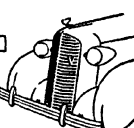
What is your preference?

☐ 	☐ 
Smooth Contour	Built-in Trunk

THE "FACE" OF THE CAR

Most people identify cars by their front end. Thus the radiator is a very important item of appearance.

Which of these styles
do YOU like best?

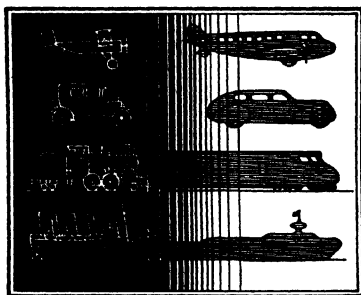
CHECK ☐	ANSWER ☐
☐ 	☐ 
☐ 	☐ 
☐ 	☐ 

"In contrast to most mechanical products (or rather to a greater degree than is the case with many other mechanical products) motor car design must give consideration to style as well as utility."

Do you favor the tendency towards

STREAMLINING

☐ Yes ☐ No ☐ Don't Care



Of all the cars on the market, and without regard to price, which would you say is the BEST LOOKING? _____

"ART IS NOT A THING SEPARATE AND APART—ART IS ONLY THE BEST WAY OF DOING THINGS."

—Elbert Hubbard.

FIG. 63.—Sample of questionnaire used by General Motors Corporation in customer research. (Reprinted with the permission of the Company.)

determine what the consumers or customers want. The results of the questionnaires are analyzed and used to devise or improve marketing methods and the products. Some companies even produce a limited number of products, take them to the consumers, who actually try them out, to see how they sell and how they are liked. The company obtains suggestions, from which the products and marketing methods are improved to meet the needs, tastes, and desires of the consumers.

Besides the market analysis, the modern manager may be able to make a saving by analysis of the distribution and transportation methods as they relate to the marketing of products. Because of this, some companies make detailed studies of the methods of transporting commodities from their factories to different localities, or raw materials from different localities to their plants. These studies have revealed the shortest routes of transportation and thereby saving in transportation cost, and in the end, less distribution cost.

SELLING THE PRODUCT

After modern management knows what the consumer wants and produces it, there is still the job of selling the product and building an organization to perform the sales functions. The type of sales organization will naturally depend upon the product or products, the methods of marketing, and the methods of distribution. If the product is small and requires many sales to a large number of customers, the organization will probably be different from that for a large product or one sold to only relatively few customers. Similarly, the sales organization of a small company may be different from that of a large one.

Almost every company has a number of possible methods of distribution: (1) selling direct to the consumer, (2) selling to the retailer, (3) selling to the wholesaler who sells to the retailer who sells to the consumer, or (4) selling to the broker, and in turn to the jobber, to the retailer, and to the consumer. There may even be variations of these methods; for example, a company may sell to a mail-order house directly, or through a jobber, or through a broker. Some companies find combinations of these methods more successful than just one. A thorough study of the products, the company, the markets, and the different methods of distribution should result in the selection of the proper type of sales organization.

If a company handles its own sales problems, several types of organizations are possible. It may have a sales manager who has charge of all the selling of the product. The sales territory may be divided into districts with someone in charge of each district, or the salesmen may go directly from the central sales office without having definite segregated districts.

Besides the strictly sales function, the marketing division usually has the advertising and publicity, and the market analysis and planning functions, under the manager of marketing or the sales manager. These functions are usually included under marketing even in the different types of sales organizations whether it be centralized or by districts. Another method of organization is to divide the sales functions according to products, having someone in charge of the sale of each product or group of products, such as the manager of sales of gears, pumps, compressors, or engines. If the company is large enough it may have a salesman for each one of these products in each sales district.

Whatever the type of sales organization, every company has the job of actually selling its products—salesmanship—whether it has numerous small sales each year or relatively few large sales to a small number of customers.

In recent years certain effective sales procedures have been developed to sell products. The best ones endeavor to apply the scientific method to selling. This application consists of the following:

1. The collection of facts.
 - a. Thorough knowledge of the facts about the product and the principles of salesmanship.
 - b. Development of prospective customers from possible consumers.
 - c. Collection of information about prospective customers.
 - d. Determination of motives for buying the product.
2. The classification of the facts.
 - a. Adaptation of the facts about the product to the customer's needs.
 - b. The presentation of the facts to the customer by means of an interview, demonstration of the product, etc.
 - c. Meeting objections.
3. The closing of the sale based upon the facts.
4. Service and follow-up.

From the viewpoint of management, the collection of facts about the product involves not only the collection of detailed information about the products but also the preparation of those facts in such a form that the salesman will understand them

thoroughly and also in such a manner that the salesman can present them convincingly to the customer in the way that the management desires. Some companies prepare books of facts giving general, detailed, and technical information which the salesman can use in presenting the proper facts to the customer. Examples are the *Janitrol Fact Book* of the Surface Combustion Corporation, and the information booklet on electric Hotpoint ranges and water heaters, issued by the General Electric Company. Modern management should not be content with simply providing the facts about the product but also should see that the salesmen are familiar with those facts, with the principles of salesmanship, and with the methods of selling.

Numerous books have been written concerning the principles and methods of selling, but in the last few years there seems to be a growing opinion that the generalizations or general principles of salesmanship cannot be used similarly with different products but that they must be adapted to the particular product being sold. This has led a number of companies to prepare sales manuals for their specific product or products. An excellent example of such a sales manual is that of the Surface Combustion Corporation. These manuals usually contain a history of the company, the methods of developing prospects, preparing for the sale, the methods of interviewing, making demonstrations, meeting objections, and closing the sale, as applied to the specific product of the company. Such manuals include not only facts about the product or products but also the principles of salesmanship.

The principles of salesmanship have been stated in a great many ways. The methods of stating them will vary with almost every writer on salesmanship and every salesman, because selling is such an individual matter between each salesman and every customer. In general, however, we can say that these principles involve the steps given previously in the outline of the application of the scientific method to selling. In sequence, they involve first the development of prospects. In selling heating equipment, for example, prospects might be sought by door-to-door canvassing, direct selling, and the taking of a census of prospects from home owners' lists, auto owners' lists, builders and contractors, neighbors of owners, lists of physicians, lawyers, city officials, and industrial officials, stores, churches, various

clubs, societies, and other organizations. The development of prospects for the purchase of electric motors involves different sources, but in general the first step is to obtain as complete a list of prospects as possible through search and research. After the prospects have been determined, the second step is to obtain as full financial, personal, family, and other information as possible about the prospects. Thirdly, comes the pre-approach—thinking through the interview with the immediate prospect and adapting the facts about the product to those about the prospect.

After going through this pre-approach, the final steps are to gain an interview courteously, demonstrate the product carefully, present the facts to the customer, meet the objections, and close the sale.

Knox¹ says that the following are some of the fundamental laws of selling:

First, you cannot antagonize and influence at the same time.

Second, what an individual does not understand, his tendency is to oppose.

Third, the Law of Self-Interest. This is one of the most fundamental laws of human nature from the standpoint of salesmanship.

The seven mental steps indicated below are the psychological engineering processes by which you can tunnel through the thickest skull and into the head and heart of the prospect:

First, he must be met personally, and thus the introduction is the first step.

Second, his attention must be attracted favorably toward the article offered for sale. To do this the salesman is required to quickly create a pleasurable sensation in the prospective customer's mind. The reason many salesmen do not get a hearing is that they fail to make a good impression on the outset.

Third, the interest of the prospect must be aroused.

Fourth, the salesman must convince the prospect that it is to his advantage to buy.

Fifth, the salesman must create a desire for his proposition.

Sixth, he must make his prospective customer resolve to get it.

Seventh, and most important, he must know how to close the order.

This selling procedure is represented graphically in Fig. 64.

P. Y. Tummy,² after a number of years of successful selling experience, has found the following four rules of making sales: The salesman must show the gain to the buyer after buying; emphasize and prove the quality of the product; instill confi-

¹ J. S. Knox. *Salesmanship and Business Efficiency*. Oak Park, Ill.: The Knox Business Book Co. 1936. Pp. 173-5.

² In charge of sales for the General Electric Company at Grand Rapids, Michigan. These principles of salesmanship were given by Mr. Tummy to the author's students.

dence on the part of the buyer in the seller; and explain who in other sales has profited by purchasing the product or products.

Much has been said about the general buying motives of customers. Books on salesmanship and psychology analyze the mo-

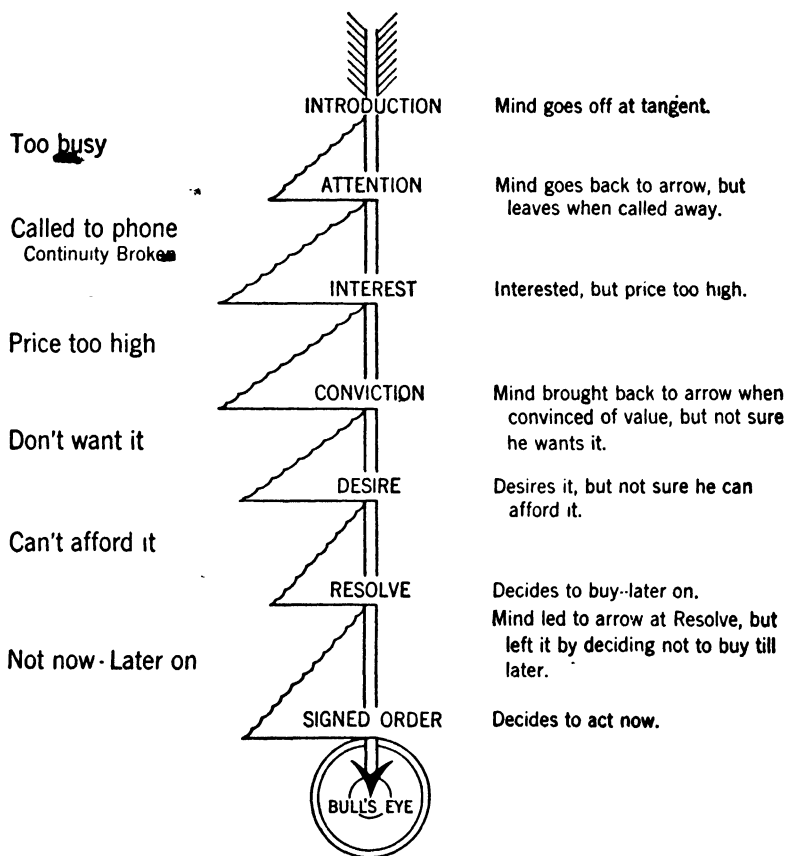


FIG. 64.—The Mental Law of Sale Chart. The crooked lines on the left indicate where prospective buyer's mind left the arrow as a result of objections. The straight lines back to arrow indicate power of salesman. (J. S. Knox. Op. cit. P. 174.)

tives which inspire people to buy. Russell¹ has given the following as the principal buying motives: (1) money gain, (2) pride, (3) imitation, (4) desire for knowledge, (5) possession, (6) health, (7) fear, (8) physical pleasure or comfort, (9) love of others, and (10) play.

¹ A. Russell. *Textbook of Salesmanship*. New York: McGraw-Hill Book Co. 1933. Pp. 80-4.

If salesmanship could be approached from a generalized viewpoint, perhaps such a list as this would be adequate, but as selling is such an individual matter, there has grown up in the last few years the idea that the buying motives applicable to each specific product being sold should be determined and applied to that specific product instead of considering a product from the standpoint of general buying motives. For example, one sales organization found the following buying motives applicable to their particular product in the order given by customers: (1) money, (2) utility, (3) caution, (4) pride, and (5) pleasure. As a general principle, then, the motives by which people buy a certain product should be investigated and determined, as well as the facts which will arouse those motives in the customer as they relate to the specific product. Those motives which apply to the specific product should then be stressed to the individual customer in the manner in which they will appeal to that particular person.

Whatever the appeal or the motive stressed, the customer will usually have objections. One of the principles in many of the sales manuals is, "Don't argue." Meet the objection by facts even if it takes an additional interview.

After the objections have been met, the closing of the sale is important because oftentimes a salesman says too much. Whenever a sales representative feels that the moment has arrived when the customer is satisfied with the product, he should attempt to close the sale. The salesman should practically always ask for the order. If "No" is given, "Why?" can be asked. Again objections should be met with possibly a summary of the real reasons for buying. Ask for the order and close the sale.

With many products the sale is not the final step. A satisfied customer means service in following up the sale. In the near future *service on the product may be one of the most important features of selling*. However, at present the follow-up and service are important, and should be taken care of adequately and well.

ADVERTISING, PUBLICITY, AND PUBLIC RELATIONS

After analysis of the market and the development of a sales organization, and along with the actual selling, goes the advertising of the product or products. Advertising in recent years

has become practically a profession in itself. It has been studied scientifically from the psychological and other viewpoints.

The result sought from advertising is to sell products.

In light of direct research with the readers of advertising, Jenkins¹ has given the following as the psychological aims of an advertisement:

I. The primary aim of advertising is always to influence human action. Since the copy theme or advertising message has been found to be the chief means of influencing action, this must be brought to its most effective level. This ~~will~~ involve a search for a specific copy theme in a particular market at a particular time.

II. The accessory aims of advertising include all steps necessary to make the total advertisement an effective governor of action. Since it is not necessary to obtain maximal effectiveness, general rules from other researches will be adequate to guide the handling of these accessory features. Typical accessory features include those items designed to:

1. Secure and hold the attention of the reader.
2. Make a clear and coherent impression.
3. Make an impression which will last for a time.

The modern manager has the job of having advertising material prepared to accomplish those aims with a specific copy theme or advertising message for the particular commodity, market, and time.² This emphasizes then that generalized advertising is greatly out of date, and that strict specificity of the advertising of the product concerned is in order.

Although these aims may apply to all types of advertising in newspapers and journals, radio, general publicity, handbills, posters, etc., the type employed will, of course, depend upon the product, the company, and the marketing methods, the type producing the most sales being used the most. The test of the type to employ and, in fact, of all advertising is the measured results in increased sales or replies from the advertisements.

The measure of advertising cannot in many cases be determined by the personal opinion of the manager or his advertising department, but should be measured by the results of the specific ad or ads. Advertising can be measured by the use of return coupons on the advertising copy, by obtaining the opinions of a number of persons who have seen the advertisement or who purchased the product because of the advertising, by comparison

¹ J. G. Jenkins. *Psychology in Business and Industry*. New York: John Wiley & Sons. 1935. P. 259.

² J. G. Jenkins. *Op. cit.* P. 257.

of sales volume in one locality to that in another where different advertisements were used, by interviewing a sample of the reading public after the appearance of the advertisements in a certain locality, and by the recall of the ads by persons who have seen them. The trend in recent years in advertising seems to be to apply the advertising, and especially the central theme of the copy, to the specific buying motives as they relate to the particular product and not to general buying motives.

Besides the direct advertising, much can be obtained along this line from general publicity of the company and its product. For example, in 1936, there appeared many articles on aluminum and its manufacture, celebrating the fiftieth anniversary of the discovery of aluminum. This not only gave interesting facts about aluminum, but indirectly advertised the product.

Some companies ask their officers and sales forces to make speeches about their companies and products, realizing that it is good advertising and publicity for the companies and products.

A large steel company teaches its sales force public speaking and endeavors to improve the personality of its salesmen and representatives who deal with the public, to "sell" the company and its product, because they consider that the personality of the company is judged by that of its people, and that, if the company's representatives have good personalities and can present well the facts about the company and its products, those actions will reflect favorably to the company and its representatives.

A number of companies, in recent years, have established public relations departments to promote satisfactory relations between the company, its employees, and the public in general. This has been especially true of the public service companies. Also, some industrial concerns have found it necessary to protect their interests from extreme criticism and governmental regulations by promoting their interests in communities and in governmental bodies. With the possible trend toward the more strict regulations of industry and business as exemplified by the National Recovery Act, the National Labor Relations Bill, and various New Deal legislation after 1933, the modern manager may find it necessary to participate more and more in community, public, and governmental affairs in order to promote the interest of his company and protect himself from too strict regulations of his management.

SPECIAL ASSIGNMENTS

1. Lay out a market analysis program for a particular product in a special locality at a selected time. (Assume product, locality, and time.)
2. Report in detail the following of a particular company: (a) the sales organization and functions, (b) the making of a market analysis, (c) methods of advertising and publicity, (d) the sales manual.
3. Prepare a sales brief for a selected product, giving the buying motives and how you would appeal to them.
4. Outline the methods of selling a particular product (assume the product).
5. Prepare an advertisement for a product (select the product).
6. Report on the subject of cooperative marketing. (See Selected References on cooperative marketing at end of this chapter.)

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- (15) J. P. WARBASSE. *Cooperative Democracy*. New York: Macmillan Co. 1936. Third Edition. 1936. (Also *What is Cooperation?*)
- (16) Also books, bulletins, etc., of the Cooperative League, 167 W. 12 St., New York City.

CHAPTER IX

MEASURES OF MANAGEMENT

In recent years management has had to measure its performance by the actual results shown. Without some proof or measure of its performance management has not completed its job. Some of the methods of measuring management are: (1) research; (2) profits and budgets; (3) performance ratios, percentages, indexes, rates, comparisons, efficiencies, and physical quantities; and (4) social service.

RESEARCH

Research is important to the management from two standpoints: from that of measuring the results of management; and from that of general industrial research for the purpose of finding new products, improving quality, reducing costs, using by-products, and developing new fields of application.

One of the important methods of finding what management has accomplished is through research, which is the application of the scientific method to the results accomplished by management. This would mean the collection of the facts about those results, the classification of those facts, and the maintenance of those methods and results which the facts prove are the best for management. From the standpoint of new management methods, a similar procedure of approach can be used. That is, the collection of facts about the new method, the classification of the facts about the new method with reference to the advantages and disadvantages of it in comparison with the old, and the selection or rejection of the new method based upon the facts obtained. Therefore management should apply the scientific method to its old as well as its new methods. Although management research as such is concerned principally with the management methods, the whole subject of industrial research is vital to the advancement of industry in general or any company in particular.

Industrial research has a broader aspect than purely manage-

ment research, because it can be pure research on some fundamental industrial or technical problem, practical research on new products or problems, or the development of old products into new forms or new uses.

The National Research Council found the following emphases in the industrial research programs in 1932 :

1. New products—38 per cent.
2. Improved quality—37 per cent.
3. Reduction in production costs—19 per cent.
4. The development of new fields of application—5 per cent.
5. By-products—1 per cent.

With reference to the development of new products, Dr. E. R. Weidlein, Director of the Mellon Institute for Industrial Research, has given the following stages in all research that culminates in a new branch of manufacture :

1. The scientific investigation (basic production research) that effects the new product or process.
2. Production research, first on the sub-commercial scale and then on the factory scale, to determine plant operating procedure, raw materials and their handling, and plant manufacturing costs and output.
3. Commercial or merchandising research, which has for its aim, through cooperative study by the research laboratory and the production and sales departments, the obtaining of complete information respecting present and probable future markets for the novel product or products. Hand in hand with the market analyses there must be conducted consumer tests or service trials. Then, too, the research laboratory must be constantly alert for possible new commercial applications.¹

In other words, this may be considered from two angles, fundamental research and applied research, followed by the placing of the results of applied research into manufacturing and on the market. The average manager may think that most of the things with reference to his business have been discovered, but if he should obtain the services of an expert research engineer he might soon learn differently. If he would attend the meetings of such organizations as the Chemical Foundation, Inc., and the Farm Chemurgic Council, he might realize the vast amount of research that is yet needed in industry on such products and materials as power alcohol, starches and sugars, plastics; cellulose, soybeans, insecticides, and fertilizers. Research

¹ E. R. Weidlein. "Research with Terminal Facilities." *Proceedings of the Second Dearborn Conference of Agriculture, Industry and Science*. Dearborn, Mich.: The Farm Chemurgic Council. May, 1936. P. 20.

is still needed not only on many of the old products but also on the new ones.

Whether it be an old or new product on which the manager wishes to do research, he may need an expert who can apply the scientific method adequately to the collection of facts, the classification of those facts, and the development of new facts from the recombination of the old facts or from the use of the imagination and foresight. Though imagination and foresight are greatly needed in research, so are persistence and patience. Edison investigated thousands of filaments before he found the right one for the electric light. Pasteur spent years to find one remedy for hydrophobia. Taylor used thousands of pounds of metal in developing his high-speed steel. Most discoveries require years of persistent painstaking research comprising hundreds or thousands of experiments.

If a manager wishes to carry on research he has the problem of developing some type of organization, finding someone in his own company to do it, or having some agency or person outside perform the research function for him. If he wishes to do the research within his company he may establish a research laboratory. The DuPont Company, the Bell Telephone Laboratories of the American Telephone and Telegraph Company, and General Motors Corporation have such laboratories. In these and similar companies a centralized research department carries on most of the research work of the company.

In some companies the research is decentralized in each functional department—production, sales, or by products—such as tire research and tube research in the rubber companies. Under the decentralized plan, the research pertaining to the separate department is done in that department's laboratory.

In other companies the research is accomplished in an informal way, the person interested in the research carrying it on as a side line to his regular managerial or other work.

If the company is not large enough or cannot afford to carry on its own research, a number of possibilities for having its research done are available, among them the following:

1. The research laboratories in the universities.
2. The governmental research laboratories, as the Bureau of Standards and the Bureau of Mines.
3. The cooperative industrial research laboratories, as the Portland Cement Association.

4. Industrial fellowship research laboratories, as the Mellon Institute of Industrial Research.
5. The foundations' research laboratories, as the Rockefeller Institute for Medical Research.
6. The private consulting research laboratories, as Arthur D. Little, Inc.

Whether the research is done within the company or through one of the outside resources it involves expense. One company spent 2.8 per cent of the total sales per year for research. This may seem large to some managers, but when it is considered that for every dollar of research cost in that company \$8.50 worth of new products were developed it does not seem expensive.

Any company's products may become obsolete very rapidly because of new discoveries and developments, and today the modern manager must keep abreast of the times if he is to remain in business long. He must carry on some sort of research continually, not only upon his own products but also upon his own management procedures, and, in fact, upon all phases of his business in order to keep ahead of his field.

PROFITS AND BUDGETS

Probably one of the most-used measures of management is profits. If a manager pays dividends and makes profits he is usually considered successful. Profits have been the keystone of industrial existence. If one manager makes more money than his predecessor he is usually considered the better from the standpoint of management. Usually the higher profits represent better management, as discussed at the end of Chapter IV, "Money."

An excellent method of determining profits and measuring management performance in the company as a whole and in each department is by means of budgets. Recently when a new president took over the management of a large company manufacturing refrigerators, one of the first management devices which he installed was an adequate budget system. He placed each department on a budget so that he could measure how each department performed by comparing actual results to the budget.

Each year or each accounting period a budget is set for each department's expenses, and at the end of the period the manager can see whether the department has gone over or under the budget set. The budget usually serves to measure the efficiency of the department from the standpoint of expenses, of

TABLE XV
VARIABLE BUDGET INCOME STATEMENT *

ITEM	Sales capacity, per cent					
	60 per cent		80 per cent		100 per cent	
	Amount	Cents of sales dollar	Amount	Cents of sales dollar	Amount	Cents of sales dollar
<i>Net sales income</i>	\$3,600,000	100.00	\$4,800,000	100.00	\$6,000,000	100.00
Direct material.....	\$1,044,000	29.00	\$1,392,000	29.00	\$1,710,000	29.00
Direct labor.....	\$504,000	14.00	\$672,000	14.00	\$840,000	14.00
Direct cost.....	\$1,548,000	43.00	\$2,064,000	43.00	\$2,580,000	43.00
Variable manufacturing expense.....	\$378,000	10.50	\$504,000	10.50	\$630,000	10.50
Variable administrative expense.....	\$149,400	4.15	\$199,200	4.15	\$249,000	4.15
Variable selling expense.....	\$432,000	12.00	\$576,000	12.00	\$720,000	12.00
<i>Total variable expense</i>	\$959,400	26.65	\$1,279,200	26.65	\$1,599,000	26.65
<i>Grand total variable costs</i>	\$2,507,400	69.65	\$3,343,200	69.65	\$4,179,000	69.65
Fixed manufacturing expense.....	\$137,302	3.82	\$137,302	2.86	\$137,302	2.29
Fixed administrative expense.....	\$300,000	8.33	\$300,000	6.25	\$300,000	5.00
Fixed selling expense.....	\$200,000	5.56	\$200,000	4.17	\$200,000	3.33
<i>Total fixed expenses</i>	\$637,302	17.71	\$637,302	13.28	\$637,302	10.62
Operating profit.....	\$455,298	12.64	\$819,498	17.07	\$1,183,698	19.73
Fixed costs and profit.....	\$1,092,600	30.35	\$1,456,800	30.35	\$1,821,000	30.35
<i>Total net sales</i>	\$3,600,000	100.00	\$4,800,000	100.00	\$6,000,000	100.00
Division of profits:						
Operating profit.....	\$445,298	12.64	\$819,498	17.07	\$1,183,698	19.73
Excess other outgo.....	\$40,000	1.11	\$53,333	1.11	\$66,667	1.11
Net business profit.....	\$415,298	11.53	\$766,165	15.96	\$1,117,031	18.62
Interest on borrowed capital.....	\$75,000	2.08	\$75,000	1.56	\$75,000	1.25
Taxable profit.....	\$340,298	9.45	\$691,165	14.40	\$1,042,031	17.37
Income tax.....	\$44,239	1.23	\$89,851	1.87	\$135,464	2.25
<i>Surplus profit</i>	\$296,059	8.22	\$601,314	12.53	\$906,567	15.12
Dividends and reserves:						
Preferred.....	\$75,000	2.08	\$75,000	1.56	\$75,000	1.25
Common.....	\$200,000	5.56	\$200,000	4.17	\$200,000	3.33
Reserves.....	\$50,000	1.39	\$50,000	1.04	\$50,000	0.83
<i>Total</i>	\$325,000	9.03	\$325,000	6.77	\$325,000	5.41
<i>Retained profit</i>	\$28,941	0.81	\$276,314	5.76	\$581,567	9.71

* C. E. Knoeppel. *Profit Engineering*. New York: McGraw-Hill Book Co. 1933. Pp. 134-5.

course, the budget being adjusted up and down according to the work required of that department.

In recent years when a rather large fluctuation in production has existed, some companies have set what might be termed flexible or variable budgets according to the amount produced. Table XV shows a variable budget at 60, 80, and 100 per cent sales capacity.¹

If the production varies in each department, the superintendent or foreman of that department has a job of changing his methods and his staff according to his actual production. By checking up on the budget each month or each accounting period, the modern manager can measure relatively the performance of each department from the standpoint of income and expenses.

In recent years the budgets are being based upon *standard costs*, that is, what each part or production should cost as determined by computations from management specifications, as mentioned in the chapter on Money. These standard costs are then compared to the actual costs in order to show the relative efficiency of the production or management of those items upon which the comparisons are made.

In general, budgeting has become a widely used tool of management to measure its performance, as judged, finally, by its profits.

PERFORMANCE RATIOS AND CHARTS

Though research may be able to determine management's performance in general, and though profits by use of budgets may give the financial performance of the company, it may not measure the management and performance in respect to manufacturing, materials, men, and the other factors with which the modern manager has to deal. Therefore, performance ratios, percentages, indexes, rates, comparisons, efficiencies, and physical quantities as means of measuring management and performances have been developed.

Roe² has developed manufacturing ratios for measuring management performances. Several of these are given below:

¹ Figures 33a and 33b also give a budget for overhead, profit and loss, etc., in the Duncan Electric Company, and the actual expenditures for purposes of comparison.

² J. W. Roe. *Trans. A.S.M.E.* Vol. 45. Pp. 825-37.

OPERATION	RATIO
Production With respect to plant, equipment	<u>Annual sales in dollars</u>
	<u>Plant investment in dollars</u>
	<u>Total annual output of industry</u>
	<u>Total investment in industry</u>
With respect to materials	<u>Annual sales in dollars</u>
	<u>Total annual purchase of materials</u>
	<u>Total annual output of industry</u>
	<u>Value of raw materials used in industry per annum</u>
With respect to labor	<u>Annual sales in dollars</u>
	<u>Total annual pay roll in dollars</u>
	<u>Total annual output of industry</u>
	<u>Total annual pay roll of industry</u>
Use of equipment	<u>Actual production machine hours</u>
	<u>Machine hours' capacity of plant</u>
Quality of output	<u>Goods produced which pass all inspections</u>
	<u>Total goods produced</u>

Alford and Hannum¹ have developed a method of measuring management and factory performance by using ratios based upon the unit of a kilo man-hour, k. m. h., or 1,000 man-hours of work. The ratios can be used for comparing the relative success or failure of an individual enterprise, performances of different companies in the same industry, or certain selected factors in different industries. The change in the ratios from period to period indicate the probable trend of future performance.

The kilo man-hour was selected as the base factor because it is measurable by established units, universal in use, easy to handle in computation, and influential in its effect on industrial operation.

In this method of measurement, fuel costs, manufacturing costs, material costs, wages, and other costs are expressed as dollars per kilo man-hour; investments, such as investments in machinery, are expressed as dollars per kilo man-hour; frequency and severity of accidents are expressed in number of lost-time accidents and the number of working hours lost per kilo man-

¹ L. P. Alford and J. E. Hannum. "A Basis for Evaluating Manufacturing Operations," *Trans. A.S.M.E.* MAN-51-2. Pp. 9-24. "Applications of the K.M.H. Method," *Trans. A.S.M.E.* MAN-55-7. Pp. 59-72. *Cost and Production Handbook*. New York: Ronald Press Co. 1934. Pp. 172-89.

hour; profit is expressed as dollars per kilo man-hour; and working force, as total number of workers employed per kilo man-hour. Only when factors are reduced to a common base like the kilo man-hour are the comparisons and contrasts made evident by inspection.

Numerous applications can be made of the kilo man-hour method. For example, as a method of measuring technological unemployment, four groups of statistics are used, namely: number of man-hours worked, average number of workers employed, total number of workers employed, and quantity of product output. From these, seven units of measurements are derived, such as: the employment, which is the kilo man-hours worked, a quantitative measure of employment; the productivity unit—the quantity of product output per kilo man-hour worked, a rate of production which indicates technological change; labor utilization unit—the average number of workers per unit of product, which measures the saving or waste in human effort.

Alford and Hannum have found this to be an excellent method of measuring managements' performances and of comparing the accomplishments of different departments.

Samples of other units used to measure managements, performances such as percentages, indexes, rates, ratings, comparisons, and efficiencies are shown in Table XVI.

Many managers use charts, graphs, figures, and diagrams of the different phases of management to show the progress being made in these different activities. Figure 65, A, B, C, and D, reproduces the charts which are used by the manager of an outstanding manufacturing concern in the Middle West, to show the status of the various items of his management. These charts are only a selected few of a number which this manager uses.

The top part of Fig. 65 A shows the unfilled orders by weeks in dollars and the work in process plus the raw material inventory; the lower part, the weekly orders and shipments in this apparatus division.

The top part of section B of Fig. 65 is a running chart of the status of bonus earned, bonus paid, and the labor hours per unit. The lower part of section B indicates graphically to this manager the status of production, the number of hourly rated employees, and the hours worked per week.

Section C gives the direct and indirect labor, and the ratio

TABLE XVI

UNITS OF MEASUREMENT FOR FACTORS IN INDUSTRIAL OPERATION *

Factor	Unit	Computation
Accident severity rate	Number of tabulatable injuries per 1,000,000 man-hours worked	$\text{Rate} = \frac{\text{Number of tabulatable injuries}}{\frac{\text{Number of man-hours worked}}{1,000,000}}$
Budget performance	Percentage actual performance of estimated	$\% = \frac{\text{Actual performance} \times 100}{\text{Estimated performance}}$
Departmental capacity (Sylvester)	Percentage man-hours worked (direct labor) to man-hours scheduled	$\% = \frac{\text{Man-hours worked} \times 100}{\text{Man-hours scheduled}}$
Employment (k.m.h. system)	Kilo man-hours worked	$\text{K.m.h. worked} = \frac{\text{Number of man-hours worked}}{1,000}$
Fixed capital investment (k.m.h. system)	Investment in dollars per kilo man-hour	$\text{\$ per k.m.h.} = \frac{\text{Investment in dollars}}{\frac{\text{Number of man-hours worked}}{1,000}}$
Labor budget	Ratio of actual cost of labor to actual cost of production	$\text{Ratio} = \frac{\text{Actual cost of labor}}{\text{Actual cost of production}}$
Production budget	Percentage actual production to estimated production	$\% = \frac{\text{Actual production} \times 100}{\text{Estimated production}}$

* L. P. Alford (editor). *Cost and Production Handbook*. New York: Ronald Press Co. 1934. Pp. 179-88. (Extracts from larger list.)

between the two; section D shows the trend of the number of the hourly rated employees and their average hours per week. This manager considers that constant knowledge of the factors shown here and others is essential to show what his management is doing and the trends which these factors of management are taking, in order to guide his decisions in respect to them.

Whatever the method of measuring the management's performances, one of the chief things for the modern manager to do is to measure the performance in as accurate, correct, definite, and comparable units as possible. The comparisons of departments, plants, or companies by definite and comparable units will show their relative efficiency or efficiencies.

SOCIAL SERVICE

From the standpoint of the individual company, the measurement of management would naturally be the profits, budgets,

performance ratios, employment, etc. From the standpoint of society it is measured by the amount of service which it renders to society, and the social benefit resulting from that management's production of useful goods and services.

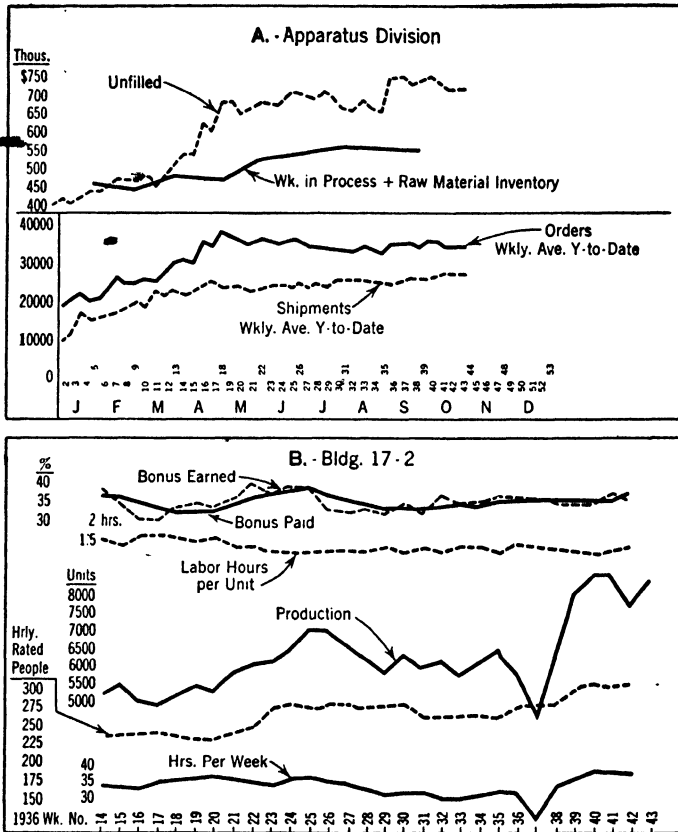


FIG. 65.—Management charts. (These charts were reproduced from those actually used in the management of an outstanding manufacturing concern in the Middlewest, by the general superintendent.)

Mass production is now possible, and if industrial plants were operated at full capacity we could produce enough to raise considerably the present standard of living, working even fewer hours than at present. It may be possible to maintain a thirty-hour week and still increase production by the improvement of management's and other methods, and by means of the further use of science in industrial mass production. Along with mass production naturally come mass management and the need for

a better distribution of the products of improved methods and managements.

In recent years a number of suggestions have been made for the mass administration of industry as a whole for social bet-

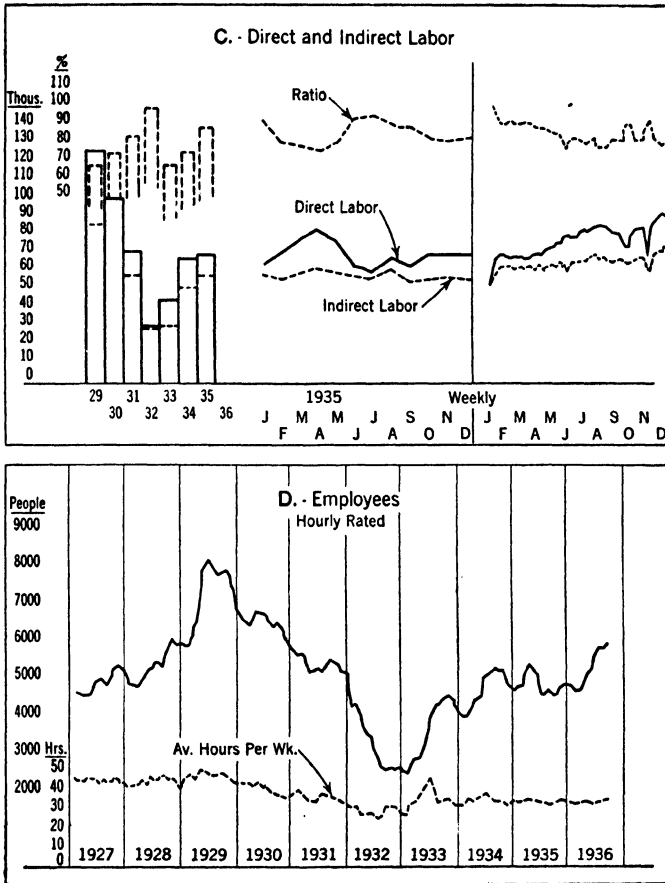


FIG. 65.—Management charts. (Continued.)

terment. Professor Homan¹ has divided the plans roughly into two divisions, those proposals for control of money and credit, and those for the reorganization of industrial control.

¹ P. T. Homan. "Economic Planning: The Proposals and the Literature." *Quarterly Journal of Economics*. Vol. XLII. No. 1. November, 1932. Pp. 102-122. (References to names or books mentioned here can be found in Professor Homan's article.)

One plan of which a number of economists and industrialists approve is long-range planning of public works. Another is the support of markets by government buying in periods of slack business. Almost all proposals favor creating greater rigidity in prices.

Sir Arthur Slater predicts the solution of the problems upon a degree of social mindedness among bankers and industrialists. Dean Donham propounds that stabilization rests upon "business" through "planning to minimize the evils of unrestricted competition," but gives few suggestions as to how it may be done. Mr. Javits proposes planning through the organization of trade associations, the elimination of selling below cost, providing for unemployment benefits or guaranteeing employment, and possibly arranging production quotas.

Mr. Swope proposes the Swope plan of unemployment and other insurance, uniform accounting, publicity of financial statements, and other features to coordinate production and consumption, all of this to be administered through trade associations. Mr. Crowther proposes the idea of controlled expansion of credit.

Mr. Person of the Taylor Society proposes the same technique of control which scientific management has developed in organizing and managing individual enterprises, for industry as a whole.

At the hearings of the La Follette Committee of the Senate in 1932, some persons favored the establishment of a national economic council to amass and analyze economic data, and to serve in an advisory capacity to government and business. Professor Clark, one of the chief proponents of this plan, also favors the control of investment and the coercive regulation of production and prices.

Professor Hobson presents the theory of over-saving and under-consumption as the primary cause of economic instability, and the removal of these for stability. Mr. Chase proposes collective control over industrial organizations, steeply graduated income taxation, control of investment, a managed currency, and a program of public works.

Mr. Beard would put all important industries on a public utility basis, with each industry organized into a syndicate controlled by a holding company, and each holding company controlled in turn by a national economic council.

Most of these plans attack the adequacy of unregulated private enterprise, and concern themselves with some form of *planning*, or "coordinated" control.

The author believes that the application of the scientific method to a planned industrial society would accomplish the best results. If one starts to plan society, one of the first difficulties is that he has not adequate facts upon which to base his decisions. Therefore it seems fitting at least to start on the collection of social facts if we wish to devise some kind of a planned society. Many of the authorities upon social planning seem to agree that society should be so planned that everyone would have the necessities of life; others contend that we should improve the present standard of living and provide some of the semi-necessities or luxuries for each person. Practically all will agree that no one should exist in poverty.

The author believes that a higher standard of living and a higher social order can be maintained if a higher level of production is maintained, and that this can be done by more intelligent industrial management and the application of science and the scientific method to planning of individual industries, of industry as a whole, and to society.

SPECIAL ASSIGNMENTS

1. Report on the methods used in a particular company to measure management's performance.
2. Report on the industrial research program of a company, trade association, or other organization or department.
3. Report on the budgeting methods of some company.
4. Report on some proposed program of *planned economy*.

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RESEARCH

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- (2) C. F. KETTERING. *Research and Social Progress*. Chicago: Washington Award Commission, Western Society of Engineers. February, 1936.
- (3) MALCOLM ROSS (Editor). *Profitable Practice in Industrial Research*. New York: Harper & Brothers. 1932.
- (4) THE FARM CHEMURGIC COUNCIL and the CHEMICAL FOUNDATION. *Proceedings of the First, and Second Dearborn, Michigan, Conferences of Agriculture, Industry, and Science*. 1935 and 1936.

OTHER METHODS OF MEASUREMENT

- (5) L. P. ALFORD (Editor). *Cost and Production Handbook*. New York: Ronald Press Co. 1934. Section 4, pp. 167 et seq.; section 24, pp. 1287 et seq.

APPENDIX A1

THE GOODYEAR TIRE AND RUBBER COMPANY

Industrial Representation Plan¹

(Since the Industrial Relations plan was amended several times, the various amendments have been incorporated into the original plan in the following outline so that this is the actual program under which Industrial Representation was effected at Goodyear. However, this plan was revoked by the company in May, 1937 before the National Labor Relations Board.)

Established June 16th, 1919

1. Executive Powers

All executive powers for operation of the Goodyear factory shall be vested in the management, and shall not be abridged in any way except in accordance with the legislative powers granted in this Industrial Representation Plan.

2. Legislative Powers

All legislative powers granted in this Industrial Representation Plan shall be vested in an Industrial Assembly of the Goodyear factory which shall consist of two (2) houses, namely a Senate and a House of Representatives.

3. The Industrial Assembly

The Industrial Assembly shall be composed of forty (40) Representatives and twenty (20) Senators, elected by the Industrials of the Goodyear factory, who shall meet separately or jointly, on the first Monday in each month in Goodyear Hall. Representatives shall be elected for one year and Senators shall be elected for two years.

Each Representative and each Senator shall have one vote.

Each House shall vote independently of the other.

Each House shall determine rules for its proceedings and shall keep a record of its proceedings.

4. Unit of Representation—Precinct and District

The Goodyear factory shall be divided into forty (40) precincts. Precincts shall be determined so as to include substantially an equal number of people, and with due regard to departmental classification of the factory.

Each precinct shall have the right to elect one Representative.

The precincts shall be further arranged into groups of four, and each group shall be named a district, and each district shall have the right to elect two Senators.

5. Method of Election and Recall of Senators and Representatives

Election of Senators and Representatives shall be held in the Goodyear Factory annually on the second Monday in October by secret ballot, and the Assembly shall be convened on the first Monday in November. At each annual election there shall be forty Representatives and ten Senators elected, except in the first election when there shall be twenty Senators elected.

A Representative or Senator may be recalled on petition signed by two-thirds of the voters in his precinct or district, and approved by two thirds of the House of which he is a member.

Upon severance of employment with the Company, a Representative or Senator shall immediately and automatically cease to hold office.

¹ Given to the author, by T. W. Prior, Salary Personnel Dept., Goodyear Tire & Rubber Co., Akron, Ohio. 1936.

6. Qualifications of Representatives and Senators

No person shall be a Representative who shall not have attained to the age of 21 years and who shall not be an Industrian of Goodyear, and not have had one year's continuous service record in the factory immediately prior to date of election.

No person shall be a Senator who shall not have attained to the age of 25 years, and who shall not be an Industrian of Goodyear, and not be in good standing on the pay roll of The Goodyear Tire & Rubber Company for five years, the last two of which shall have been a continuous service record immediately prior to election.

If vacancies occur in the Senate or House of Representatives through resignation or otherwise, the candidate receiving the next highest number of votes cast in the general election shall be considered. If he received less than 30% of the total votes cast in the respective precinct or district a special election shall be held immediately. If he received 30% or more of the votes cast, it shall be advertised in the precinct or district for one week, and if at the end of that time no objection comes to the attention of the Election Committee, said candidate shall be seated. If an objection appears, the Election Committee shall determine whether a special election is necessary and make recommendations to the respective House for such election.

7. Definition of Industrian and Qualification of Voters

A Goodyear Industrian must be 18 years of age, must be an American citizen, understand the English language, and have a six months continuous service record in the Goodyear factory.

Each employee whose name shall appear on the Goodyear factory pay roll the day preceding any election shall be entitled to vote at such election.

8. Power and Procedure of the Industrial Assembly

The Articles of Incorporation of the Goodyear Tire & Rubber Company and the laws of the State of Ohio fix the final authority and responsibility for management of the Company in its Board of Directors. Therefore, subject only to the right of the Board of Directors to veto or annul, the power of the Industrial Assembly shall be as follows:

The Industrial Assembly shall have legislative power to make changes in Factory Rules and Regulations which from time to time have been or shall be made by the management as provided in Article 1, on the subject of wage adjustments, working conditions and the adjustment of grievances in accordance with the following procedure:

Every bill which shall have passed the House of Representatives and the Senate shall, before it becomes a Factory Rule or Regulation, be presented to the Goodyear Factory Manager. If he approves he shall sign it, but if not, he shall return it with his objections to the House in which it shall have originated, who shall enter the objections at large upon their record, and proceed to reconsider it. If after such reconsideration two-thirds of that House shall agree to pass the bill, it shall be sent together with the objections to the other House, by which it shall likewise be reconsidered, and if approved by two-thirds of that House it shall become a Factory Rule or Regulation. But in all such cases the votes of both Houses shall be determined by yeas and nays and the names of the persons voting for and against the bill shall be entered on the record of each House respectively. If any bill shall not be returned by the Factory Manager within thirty days (Sundays excepted) after it shall have been presented to him, the same shall be a Factory Rule or Regulation in like manner as if he had signed it, unless the Assembly by failure to provide proper means to receive it shall prevent its return, in which case it shall not be a Factory Rule or Regulation.

9. Approval and Veto Powers of the Factory Manager

Every order, resolution, or vote, to which the concurrence of the Senate and

House of Representatives may be necessary (except on a question of adjournment) shall be presented to the Factory Manager and before the same shall take effect shall be approved by him, or being disapproved by him, shall be repassed by two-thirds of the Senate and House of Representatives according to the rules and limitations in the case of a bill.

10. District Committees

There shall be ten committees composed as follows: (1) The six members of the Assembly, four Representatives and two Senators of each district. (2) Six members of the management to be chosen, one from the Labor and one from the Efficiency Division of the Personnel Department, and the remaining four from the General Foremen or Foremen of the departments comprising each district.

The Assembly's and management's representatives of each committee shall elect a Chairman for the year. These chairmen will alternate as Chairmen of the District Committee for six-month periods, it being optional with the Committee which Chairman shall officiate for the first half of the year.

In case of absence of Assemblyman, or inability to attend district meetings, the vacancy may be filled at the request of the balance of the Committee, either by another Assemblyman, or the man who ran next highest to the absentee in the election.

One of the Personnel Department representatives shall act as Secretary of each of the ten committees and will keep written minutes of each meeting.

The District Committee shall meet regularly once a month. Schedules of meetings to be published for six-month periods.

Special meetings may be called at the request of either Chairman.

All decisions of the Committee shall be by majority vote of the 12 members.

Appeals from the Committee shall be handled as follows: (1) In case of a tie vote, the case in question shall be referred to one of the Joint General Committees, hereinafter provided for. (2) It shall be necessary that at least two members of District Committee concur in appealing a decision of the District Committee. (3) All appeals shall be made in writing, stating reasons for the appeal.

(b) Joint General Committees

There shall be three Joint General Committees, composed of six Assemblymen and six members of the management, to handle the following topics: (1) Wages. (2) Employment, Working Conditions and Welfare. (3) Safety and Sanitation.

Members from the Assembly shall be elected, three from each House respectively, to serve for terms of one year. There shall also be elected by each House two alternates for each committee, either of whom may be called upon to take the seat of an absent member of the committee.

As in the case of the District Committee, the management's representatives and the Assembly's representatives in the Joint General Committee shall each elect a chairman. The management's Chairman is to act as Chairman of the Committee for one month and the Assembly's Chairman is to act as Chairman of the Committee for the next month, and alternating in this matter throughout the year.

11. Joint Conference

The Joint Conference shall consist of the Assembly Chairman of each of the ten districts, the President of the Senate, the Speaker of the House, and twelve members appointed by the management. The Factory Manager, or person designated by him, shall act as Chairman of Joint Conference.

12. Industrial Representation Plan—How Amended

The Industrial Assembly, whenever two-thirds of both Houses shall deem it necessary, shall propose amendments to this Industrial Representation Plan, which shall be valid to all intents and purposes as a part of this plan when approved by the Factory Manager. In case amendments have been passed by a two-thirds vote of both Houses over the veto of the Factory Manager, such amendments must be approved by the Board of Directors of The Goodyear Tire & Rubber Company before becoming valid.

13. Oath of Office

Before entering upon his duties, each Representative or Senator shall take and subscribe to the following oath, which shall be administered by any officer empowered to administer oaths under the laws of Ohio: "I do solemnly swear (or affirm) that I will faithfully support the Constitution and Laws of the United States and the State of Ohio and the Industrial Representation Plan of the Goodyear Factory, and that I will to the best of my ability faithfully and conscientiously discharge the duties incumbent on me as a Representative (or Senator) under such plan."

14. Guarantee Against Discrimination

There shall be no discrimination against any Goodyearite on account of membership or non-membership in any labor organization, or against any Representative or Senator for action taken by him in performance of his duties as outlined in this plan.

15. Industrial Representation Plan—How Ratified

This Industrial Representation Plan shall become effective when a majority of the Industrials of the Goodyear Factory and the management of the Goodyear Factory shall have authorized the present Industrial Relations Council to place their signature hereon.

APPENDIX A2

EMPLOYEES' REPRESENTATION PLAN

E. I. DU PONT DE NEMOURS & COMPANY AND SUBSIDIARY COMPANIES

(Authorized June 14, 1933)

I. NAME

The name of this Plan shall be the "EMPLOYEES' REPRESENTATION PLAN," and the name of the body through which it shall be administered at each location shall be the "WORKS COUNCIL" of the particular works or operation.

II. PURPOSES

The purposes of this Plan are to promote cooperation between the Company and its employees; to give the employees a voice in matters of mutual interest, including safety, sanitation, hours of work, wages and other working conditions; to provide an orderly and expeditious procedure for the prevention and adjustment of differences; and to afford a means through which the Management may furnish information of interest to employees regarding the Company's affairs.

III. PERSONNEL OF WORKS COUNCILS

The personnel of each Works Council shall consist of representatives elected by the employees, as hereinafter provided; an equal number of representatives appointed by the Management; a chairman elected by and from the membership of the Works Council; and a secretary appointed by the Management but having no vote.

IV. BASIS OF REPRESENTATION

1. Each works shall be divided into voting divisions generally corresponding to established departmental lines. Each voting division shall be entitled to elect one representative to the Works Council, provided that no works shall have less than

two nor more than ten elected representatives. The Works Council may change these divisions whenever it considers this desirable in order to maintain a fair and complete representation.

2. Changes in number or distribution of employees occurring between regular election dates shall not necessitate any change in the number or distribution of representatives prior to the next regular election unless otherwise determined by the Works Council.

V. QUALIFICATIONS OF ELECTED REPRESENTATIVES

1. A candidate to be eligible for election as a representative must (a) be 21 years of age or over, (b) be an American citizen or an alien who has declared his intention of becoming a citizen, (c) have at least one year of continuous service with the Company, and (d) at time of nomination and election be employed in the voting division which he is to represent.

2. Company executives, foremen and others having power to hire or discharge shall not be qualified to act as elected representatives.

VI. QUALIFICATIONS OF APPOINTED REPRESENTATIVES

An employee to be eligible for appointment as a representative must (a) be 21 years of age or over, (b) be an American citizen or an alien who has declared his intention of becoming a citizen, and (c) have at least one year of continuous service with the Company. The distribution by voting divisions of appointed representatives should, as far as practicable, conform to that of the elected representatives.

VII. QUALIFICATIONS FOR VOTING FOR REPRESENTATIVES

Any employee in the service of the Company on the dates of nominations or elections shall be entitled to vote for representatives; *except* that Company executives, foremen and others having power to hire or discharge shall not be entitled to vote.

VIII. NOMINATIONS

1. Nominations shall be made annually on the first Wednesday in April unless this date falls on a holiday or during a shut-down of operations, in which case they shall be made on the next regular working day.

2. Nominations shall be by secret ballot and so conducted as to avoid any influence or interference with voters, to prevent any fraud in the casting or counting of ballots or otherwise, and to afford all employees an opportunity to vote.

3. On the day for nominations each qualified voter shall be given a ballot on which he shall clearly print, or cause to be printed, the name of the employee whom he desires to represent his division. He shall then personally deposit the ballot in a box provided for that purpose.

4. If on any ballot the name of more than one employee is designated for nomination, the ballot shall be void.

5. The two employees in each division receiving the highest number of votes shall be the nominated candidates for election.

6. In the event of a tie vote, seniority in length of Company service shall determine the choice.

7. Nominations and counting of the ballots shall be under the supervision of a special committee selected by and from the elected representatives in the Works Council; and as soon as the ballots are counted the result shall be posted and the ballots sealed and safeguarded for thirty days following election.

IX. ELECTIONS

1. Elections shall be held annually on a date one week after the nominations unless this date falls on a holiday or during a shut-down of operations, in which case the election shall be held on the next regular working day.

2. The election shall be by secret ballot and so conducted as to avoid any influence or interference with voters, to prevent any fraud in the casting or counting of ballots or otherwise, and to afford all employees an opportunity to vote.

3. On the date of election each qualified voter shall be supplied with a ballot on which shall be printed the names of the candidates in his division for one of whom he is entitled to vote.

4. Each voter shall indicate his preference by marking an "X" opposite the name of the candidate of his choice, and shall personally deposit his ballot in a box provided for that purpose.

5. If on any ballot more than one candidate is voted for, the ballot shall be void.

6. In the event of a tie seniority in length of Company service shall determine the choice.

7. Elections and counting of the ballots shall be under the supervision of a special committee selected by and from the elected representatives in the Works Council; and as soon as the ballots are counted the result shall be posted and the ballots sealed and safeguarded for thirty days.

8. If charges of fraud or unfairness in nominations or elections are filed in writing within two weeks after the election and investigation by the Works Council shows that the irregularities complained of were substantial and that the outcome of the election was affected thereby, a new nomination or election may be ordered by the Works Council.

X. TERMS OF REPRESENTATIVES

1. Elected Representatives:

(a) Elected representatives shall be chosen for a term of one year, and until their successors are duly elected and qualified. Elected representatives shall be eligible for re-election.

(b) Nominees failing of election shall stand as alternates and become representatives from their respective divisions as need may arise through vacancies, or act temporarily as representatives, upon the approval of the Works Council, during any prolonged absence of a regular representative. A vacancy in the office of representative for which there is no alternate may, in the discretion of the Works Council, be filled by a special election conducted in the same manner as a regular election.

(c) An elected representative may be recalled on petition signed by two-thirds of the voters in his division.

(d) If an elected representative leaves the service of the Company, or is absent from more than three consecutive meetings of the Works Council without such absences being excused by the Works Council, or is appointed to such a position as would make him ineligible for election as an elected representative, he shall immediately and automatically cease to hold office.

2. Appointed Representatives:

Appointed representatives shall hold office for a term of one year from the date of election of elected representatives and until their successors are duly appointed and qualified; provided, that the Management may at any time remove an appointed representative and appoint a substitute for the unexpired portion of his term. Appointed representatives shall be eligible for reappointment.

XI. COMMITTEES

The Works Council may appoint such committees from among its own members as it deems necessary for the efficient conduct of its business. All such committees shall be composed of an equal number of elected representatives and appointed representatives. The Works Council shall designate the chairman of each such committee.

XII. MEETINGS

1. The Works Council shall hold regular bi-monthly meetings; provided, however, that regular meetings may be held either more or less frequently in the discretion of the Works Council. Special meetings shall be called by the Chairman at the request of the Management or of one-third of the elected representatives.

2. At any regular or special meeting any elected or appointed representative may present for consideration or investigation any matter of interest coming within the scope and purposes of this Plan; but matters affecting one or more employees and susceptible of adjustment between them and their immediate superiors shall not be presented in the Works Council unless and until efforts shall have been made to effect such adjustments as hereinafter provided in Article XIII, Sections 1, 2, 3 and 4.

3. Two-thirds of the elected representatives, together with two-thirds of the appointed representatives, shall constitute a quorum and no business shall be transacted at any meeting unless a quorum is present. In no case shall the number of appointed representatives eligible to vote at any meeting exceed the number of elected representatives eligible to vote, or vice versa.

4. The Company shall provide suitable places for meetings of the Works Council and its committees.

5. Representatives in attendance at any meeting of the Works Council or its committees, and employees attending any meeting at the request of the Works Council or any of its committees, shall receive their regular pay from the Company for such time as they are necessarily absent from work for these purposes.

6. If the Chairman of the Works Council is unable to attend a particular meeting, the Works Council may designate a substitute to act at such meeting.

7. The Secretary of the Works Council shall keep accurate records of the attendance at and the proceedings of all meetings, which shall be open to the inspection of any representative.

XIII. PROCEDURE

1. Any matter concerning one or more employees in a works division shall first be taken up with the foreman concerned by the employee or employees concerned.

2. If not adjusted, the matter shall then be presented by the employee and his division representative to the foreman.

3. If a satisfactory adjustment is not then obtained, the matter shall be presented by the employee and/or his division representative to each higher ranking executive in turn in the line organization until it reaches the head of the employee's works division.

4. Failing satisfactory adjustment by the works division head, the division representative shall place the matter before the Works Council.

5. The Works Council may call any employee before it to give information regarding any matter under consideration, or may appoint a special committee to investigate the matter, or may decide on the matter immediately by a two-thirds vote of the representatives present and voting.

6. The Works Council shall then report its decision to the Works Manager. The Works Manager shall report his findings and recommendations in writing to the Works Council at its next regular or special meeting.

7. The Works Council shall then immediately reconsider the matter, and if it is unable to agree with the Works Manager by a two-thirds vote of the representatives present and voting, the matter shall then be referred, with full and complete presentations in writing covering both sides of the matter in controversy, to the President of the Company concerned. The President shall report his findings and recommendations in writing to the Works Council within thirty days.

8. The Works Council shall then immediately reconsider the matter, and if it is unable to agree with the President by a two-thirds vote of the representatives present and voting, the matter shall then be submitted to arbitration. On a decision to arbitrate, the appointed representatives shall choose one arbitrator; the elected representatives shall choose one arbitrator; and these two arbitrators shall choose a third. These three arbitrators shall be furnished all the information and testimony they deem necessary regarding the matter in arbitration. The decision of a majority of the three arbitrators shall be final and conclusive and binding upon all parties.

XIV. INDEPENDENCE OF REPRESENTATIVES

1. A representative shall be free to discharge his duties in an independent manner without fear that his individual relations with the Company may be affected by any action taken by him in good faith in his representative capacity. To assure each representative such independent action, he shall have the right to take the question of an alleged personal discrimination against him on account of his acts in his representative capacity to each of his ranking works executives in turn and then to the Works Council.

2. Should the Works Council be unable to arrive at a decision by a two-thirds vote of the representatives present and voting, the matter shall then be referred, with full and complete presentations in writing covering both sides of the matter in controversy, to the President of the Company concerned. The President shall report his findings and recommendations in writing to the Works Council within thirty days.

3. Should the Works Council still be unable to arrive at a decision by a two-thirds vote of the representatives present and voting, the matter shall then be submitted to arbitration. On a decision to arbitrate, the appointed representatives shall choose one arbitrator; the elected representatives shall choose one arbitrator; and these two arbitrators shall choose a third. These three arbitrators shall be furnished all the information and testimony they deem necessary regarding the matter in arbitration. The decision of a majority of the three arbitrators shall be final and conclusive and binding upon all parties.

XV. AMENDMENT, ALTERATION OR REPEAL

Any Works Council operating under this Plan may by a three-fourths vote of those present and voting at two consecutive regular meetings amend, alter or repeal this Plan.

XVI. ADOPTION OF PLAN

This Plan shall immediately become operative at any works upon a two-thirds affirmative vote of the employees of that works.

E. I. DU PONT DE NEMOURS & COMPANY,
LAMMOT DU PONT, *President*.

APPENDIX A₃ARTICLES OF ASSOCIATION OF DELCO-REMY EMPLOYEES' ASSOCIATION¹*August, 1934*

ARTICLE I

Title

The title of the Plan provided for by these articles is "Delco-Remy Employees' Association."

ARTICLE II

Purpose

The purpose of the Delco-Remy Employees' Association shall be to promote co-operation between Delco-Remy Corporation and its Employees along the following lines:

- 1—Hours of Labor.
- 2—Wage Rates.
- 3—Working Conditions.
- 4—Safety and Accident Prevention.
- 5—Promotion of Health.
- 6—Welfare of Employees.
- 7—Efficiency and Economy of Operations and Other Matters Affecting Employees' Interests.

This plan shall be subject to the National Industrial Recovery Act and any Codes or Regulations promulgated in connection therewith.

ARTICLE III

Employees' Association

1—a—Any Delco-Remy Employee who does not occupy a position giving him executive powers in the Plant, is eligible for membership in the Employees' Association. Employees on a salary basis of pay are not eligible.

b—Membership in Delco-Remy Employees' Association is purely voluntary.

c—If an employee is dismissed or resigns, his membership is automatically cancelled. In the event of layoff, where the employee's services are temporarily dispensed with, but where the employee's name is retained on the pay roll of the Company, membership in the Employees' Association continues and the employee is entitled to all benefits in connection therewith.

d—Change of the status of an employee with reference to the conditions dealt with under paragraph (a) above, automatically changes his status with reference to eligibility for membership in the Employees' Association, and the benefits thereunder.

2—Every member of the Employees' Association has the following rights:

a—To vote in the election of Employee Council Representatives to the Employees' Plant Committee and Department Representative as provided for in Article IV.

b—To be eligible for election or re-election as an Employee Council Representa-

¹ Given to the author by George Coburn, Personnel Director, Delco-Remy Corp., Anderson, Ind. This plan has been amended so that it is completely and distinctly the employees' voluntary organization.

tive to the Employees' Plant Committee, subject to the qualifications set forth in Article IV.

c—To make a complaint, recommendation or suggestion to the Employees' Plant Council with reference to Wages, Hours of Labor, Working Conditions or any other appropriate subject.

d—To make application for any Welfare benefits which may be provided.

e—To enjoy the benefits of Group Insurance and Savings Plans.

ARTICLE IV

Employees' Representatives

1—An Employees' Plant Council representing the Employees' Association in its dealings with the Management will be elected under the following conditions for each plant of the Delco-Remy Corporation.

a—Any member of the Employees' Association with one or more years' service immediately prior to nomination and who is a citizen of the United States, is eligible for election as a Council Representative or a Department Representative.

b—The Employees' Plant Council will consist of one representative for each 200 employees or part thereof, but not less than five for any one plant.

c—Balloting will be secret and controlled by an Election Committee of three members from each precinct composed of members of the Employees' Association appointed by the existing Employees' Plant Council. Uniform printed ballots will be furnished. No executive can participate in the election.

d—The Representatives will be elected to represent the Plant in which they are employed. The number of councilmen to be elected from each plant will be based upon the payrolls as of July 1st preceding the election.

e—Each department shall elect a Department Representative who will cooperate with the Employees' Council in matters affecting his department.

Qualifications and term of office for Department Representatives shall be the same as for Employees' Council Representatives. They will be nominated and elected by departments in the same manner as Council Representatives are elected.

In cases where a single department constitutes a precinct that department will be subdivided by the Election Committee in order that approximately each 100 people will have a person representing them to the precinct councilman.

For the purpose of unit representation and voting, the Election Committee will sub-divide each plant into precincts equal to the number of representatives that are to be elected in that Plant. In forming these precincts particular attention should be paid to the logical grouping from the standpoint of the type of work as well as from location and the approximate number of employees in each.

f—Nominations will be called for on the second Wednesday of August of each year. Nominations will be by secret ballot. Each member of the Employees' Association shall be entitled to vote for two candidates for the Councilman to be elected for his precinct. A candidate must be employed in the precinct for which he is nominated. The three qualified candidates for each office receiving the largest number of votes will be entered on the official ballot.

g—Elections will be held annually on the Tuesday following the nomination. The qualified candidate receiving the largest number of votes in his precinct shall be declared elected. Notification of election will be furnished by the Elections Committee.

h—The term of office of both Council and Departmental Representatives will begin on the 15th day after their election and will continue for one year or until their successors are elected. Any Councilman or Representative can be elected to serve not more than four consecutive terms. A Councilman or Representative can be recalled before the end of his term upon the approval by a majority of

the other members of the Employees' Plant Council of a petition signed by two-thirds of the number of his constituents.

i—If an Employee Representative shall lose his membership in the Employees' Association as provided in Article III, he shall forfeit his right to serve as an Employee Representative.

If an Employee Councilman shall transfer voluntarily to another precinct he shall be deemed to have vacated his office.

If an Employee Department Representative shall transfer voluntarily to another department he shall be deemed to have vacated his office.

j—Any vacancies occurring in the office of Employee Council or Department Representative shall be promptly filled for the remainder of the term of office by a special election in the precinct affected. The same procedure will be followed as in a regular election.

k—No Employee or Employee Representative shall be discriminated against, as a result of any action taken by him in good faith as a member of the Employees' Association.

2—Regular meetings of the Employees' Plant Council will be held the second Tuesday of each month, special meetings may be called by the Chairman of the Employees Plant Council. Meetings shall be called at 7.00 A. M. and continue until adjournment is agreed upon. The Secretary of the Employees' Plant Council will notify each member of date, time and place of meeting.

The place of meeting will be established by the Employees Plant Council.

No meeting shall proceed until a quorum, consisting of a majority of the Councilmen, is in attendance.

3—At the first monthly meeting after the newly elected Representatives take office a Chairman, Vice Chairman and a Secretary will be elected from among the members of the Employee Council to serve for the ensuing year or until their successors are elected. Minutes of all meetings will be kept by the Secretary.

4—The Employees' Plant Council will handle matters pertaining to its own Plant with the Plant Supervision. An employee may make a complaint direct to his Department Representative or through his Employee Council Representative.

To define the issue, and to provide means of recording and following to a conclusion, each petition or suggestion shall be submitted in writing.

5—Any matter, the consideration of which is of interest to all plants, shall be referred to the Employees' General Council. This Council shall consist of the Chairman of all Employees' Plant Councils and is subject to call by the General Chairman. The General Council shall meet on the Wednesday following the second Tuesday of each month at 1.00 P. M.

The Officers of the General Council shall be a Chairman, Vice Chairman, Secretary-Treasurer. The office of the Secretary-Treasurer shall be bonded in the sum of not less than one thousand dollars and in proportion to the funds in the treasury.

No funds of this Association will be expended except upon the approval of the General Council. Vouchers will be signed by the Chairman and the Secretary-Treasurer.

6—All meetings of the Employees' Council shall be private. The Council may request the attendance of any employee whose evidence is desired.

ARTICLE V

Amendments

1—Any method of procedure hereunder may be amended at any time by a three-fourths vote of the entire membership of the Employees' Councils.

APPENDIX B

MODEL LABOR UNION AGREEMENT¹

(RETAIL CLEANERS, DYERS AND PRESSERS WORKING AGREEMENT)

Recommended by The American Federation of Labor

1. Only members of Cleaners, Dyers and Pressers Local No. — to be employed. All persons doing any of the actual work in any department covered in this agreement shall become members of the Union, except employers. Employees who work in departments over which we have no jurisdiction, and who work part of the time in departments over which we have jurisdiction, and who receive less pay in the department over which we have no jurisdiction than that paid in the department over which we have jurisdiction, shall receive the pay called for in the department over which we have jurisdiction for the time worked in that department.

1a. Only — employers shall be allowed in each shop, and other owners or stockholders doing actual work in shop shall become members of this Union; but such owner or stockholders shall have no vote or voice in this Union. Only — vote shall be allowed for each plant.

2. That the party of the first part shall hire all help directly from the Union when such help is available and satisfactory. When such help is not available, the party of the first part may hire their own help; provided, however, that such help shall obtain a permit from the Local's office, and become members of the Union having jurisdiction over their work within a period of — weeks from the time they are hired.

3. That the party of the first part shall have the unquestionable right to discharge, and the employee the right to appeal to the management.

3a. No members to be discharged for upholding the Working Rules of this Union.

4. All grievances which may arise shall be given consideration as follows:

(a) All complaints and grievances to be adjusted by the foreman in charge, if possible.

(b) When such an adjustment cannot be made between the foreman and the employees directly interested, the matter will be taken up with the company direct by the Business Agent and the Shop Committee, representing the craft having the grievance, and they shall endeavor to reach a mutual understanding.

(c) In the event that an understanding cannot be reached by the employer and the representative of the craft involved, a committee of representatives of all the organizations will meet the employers and try to bring about an adjustment of the grievance, and in the meantime there will be no lockout on the part of the Company or strike on the part of the employees.

5. — hours to constitute a day's work; these hours to be mutually arranged between — A.M. and — P.M., except where two or more full shifts are necessary and except in the Marker's Department, where the hours shall be mutually arranged in straight shifts between the hours of — A.M. and — P.M.

¹ Given to the author by Frank Morrison, Secretary, American Federation of Labor, in 1934.

6. Any time over — hours shall be considered overtime, and shall be paid for at — rate of the regular wage scale.

7. All work outside of — A.M. and — P.M. shall be considered overtime, and shall be paid for at — rate of the regular wage scale, except when two or more full shifts are necessary and except in the Marking Department, where all hours outside of — A.M. and — P.M. shall be considered overtime.

8. Sundays and holidays, if worked, to be paid for at the rate of — time of the regular wage scale and the following days to be considered as holidays: New Year's Day, Decoration Day, July Fourth, Labor Day, Thanksgiving Day, Christmas Day, and Armistice Day.

9. Employees to be paid only for time worked, except that when working for less than one-half day owing to lack of work, they shall be paid for one-half day.

10. All work must be divided equally so far as practicable among employees during the dull season.

11. Only one foreman or one forelady will be recognized in any shop.

12. — apprentice shall be allowed to every — help or less in each shop, except when competent help is obtainable, there shall be a competent journeyman employed in the department in which the apprentice is required.

13. An apprentice is to receive — dollars per day and after — month's service, if retained, their wages to be increased by the employer according to the class of work they are doing.

14. All work shops shall be sanitary and so arranged that all employees will be able to work the major portion of the hours between — A.M. and — P.M. by natural light.

15. This is a minimum scale and any employee receiving more than the minimum wage scale previous to the time of signing this agreement shall not be reduced.

16. It is understood that this is a weekly scale, and prohibits piece work, with exception to drivers and tailors which shall be optional.

17. A qualified representative of the Cleaners, Dyers, and Pressers Local, No. — shall be allowed admission to all work shops, provided they do not interfere with the work.

18. The party of the first part agrees that help employed in the Cleaners, Dyers, and Pressers establishments become members of the Union within — week after the signing of this agreement; in the event of the refusal to join the Union or rejection by the Union, the party of the first part agrees to remove such help within — week of the time of notification in writing, by a representative of the party of the second part.

19. Employees to work in other departments when necessary.

20. All employees involved in strikes shall be reinstated in their former positions in preference to others as soon as there is sufficient work in their respective departments.

21. It is further agreed that at any time there is a radical increase or decrease in the cost of living over the present cost, — days' notice in writing may be given of a desire to change the scale to meet such added cost, during which time conference shall be held with the representatives of the party of the first part, and representative of the party of the second part and the Central Labor Council, with a view to bringing about a proper adjustment. It is understood that the post mark on the letter with enclosed notice shall be considered as the date of the notice.

MINIMUM WAGE SCALE

Dyers

Dyers..... per week \$_____

Spotters _____Yrs. Apprenticeship.

Master spotters..... per week \$_____

Silk "..... per week \$_____

Plain, dark "..... per week \$_____

Dry Cleaners _____Yrs. Apprenticeship.

Dry cleaners..... per week \$_____

Busheling _____Yrs. Apprenticeship.

Bushelman..... per week \$_____

Seamstress..... Wks. Apprenticeship per week \$_____

Men Pressers _____Yrs. Apprenticeship.

Pressers, men's garments, machine..... per week \$_____

Pressers, ladies' " fancy..... per week \$_____ _____Yrs. Appr.

Machine, ladies' " plain..... per week \$_____ _____Mo. Appr.

Markers and Entry Clerks

Entry clerk _____ Mo. Apprenticeship..... per week \$_____

Bookkeeper and marker..... per week \$_____

Foreman in each department to receive _____ per day over the regular wage scale.

23. These rules and regulations shall supersede all others and shall take effect when signed by the contracting parties. In case either party desires a change in this agreement, _____ days' notice shall be given in writing before the expiration of said agreement. If no such notice is given in writing, the agreement shall continue on indefinitely still requiring the _____ days' notice.

Signed for the company

Signed for the organization

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Central Labor Council

APPENDIX C

LETTER WRITTEN TO THE EMPLOYEES OF THE DUNCAN ELECTRIC COMPANY GIVING THE CONDITIONS OF THE SOCIAL SECURITY ACT AND THE INDIANA UNEMPLOYMENT COMPENSATION BILL.

DUNCAN ELECTRIC MANUFACTURING CO.

LA FAYETTE, INDIANA

October 28, 1936

TO EACH EMPLOYEE OF
DUNCAN ELECTRIC MFG. CO.,

We recently received from the Honorable C. A. Jackson, Director of the Indiana Unemployment Division, Department of Treasury, State House, Indianapolis, a suggested "Notice" regarding Unemployment Compensation and Old Age Benefits. You will find a copy of his suggested notice attached to this letter. My reason for writing this letter to you is that it seems to me some of you may wish more information than he gives. The task is not an easy one, and I hope you will forgive me if I fail to make it easy reading. In case you desire to study the State and Federal Acts themselves, your foreman will arrange to secure copies for you.

OLD AGE BENEFITS AND PAYROLL TAXES THEREFOR

Old Age Benefits have nothing to do with old age "pensions" or with old age "assistance." Old age assistance is only for those who have not been taxed to provide their own old age benefits. In general, amounts paid under old age assistance are to be less than those paid under old age benefits.

The Federal Act does not say these payroll taxes are for old age benefits. In fact, as far as the law goes, this money is to be used for the general expenses of Government. However, the law anticipates that Congress will appropriate a sufficient sum each year to build up the large reserve contemplated, and Congress is specifically authorized to make such appropriations. One Congress cannot force a succeeding Congress to make specific appropriations. Presumably Congress will make use of these payroll taxes for this purpose. The reserve will be in the form of Government Bonds.

Title II of the Federal Social Security Act describes the old age benefits, and Title VIII levies the taxes with respect to employment. There is no cross reference between Title II and Title VIII.

Tax Provisions

Taxes are imposed on wages under the following provisions:

- (a) During the calendar year 1937, 1938 and 1939, every employer shall pay an excise tax equal to 1% of the wages paid by him to each employee. The tax will be increased for each three-year period thereafter by one-half of 1% of wages until it reaches a maximum of 3% beginning January 1, 1949. Every employee shall pay an income tax with respect to his wages at the same rate as the employer's excise tax, the tax to be deducted by the employer from his wages as and when paid.
- (b) No taxes are to be paid with respect to an employee after he attains age 65.
- (c) The employee's share of the tax cannot be deducted in computing his net income for income tax purposes.

- (d) Provision is made for the collection of the tax by the Bureau of Internal Revenue by means of stamps, coupons, tickets, books or other reasonable devices or methods as may be prescribed by the Commissioner of Internal Revenue. Stamps, coupons, and similar devices so prescribed are to be issued through the Postmaster General. These collections shall be paid into the Treasury of the United States.
- (e) The tax is to be paid on all remuneration for employment including the cash value of all remuneration paid in any medium other than cash. However, only that part of the remuneration which does not exceed \$3,000 in any one calendar year, received from any one employer, is subject to the tax.

Excluded Classifications

Wages received by persons while in the following classifications are not subject to the taxes:

- (a) Agricultural labor;
- (b) Domestic service in a private home;
- (c) Casual labor not in the course of the employer's trade or business;
- (d) Officers or members of a crew of a legally documented vessel;
- (e) Employees of the United States government or an instrumentality of the United States;
- (f) Employees of a State, political sub-division, or instrumentality thereof;
- (g) Employees of non-profit-making institutions, organized and operated exclusively for religious, charitable, scientific, literary, or educational purposes, or for the prevention of cruelty to children or animals.

Old-Age Benefits

The following provisions apply to old-age annuity benefits:

- (a) To qualify for an annuity an individual must be at least 65 years of age; must have received total wages of not less than \$2,000 after December 31, 1936, and before attaining age 65; and must have received wages with respect to employment on some five days, after December 31, 1936, and before attaining age 65, each day being in a different calendar year.
- (b) The annuity will be paid monthly by the Secretary of the Treasury beginning on the date the employee attains age 65 or on January 1, 1942, whichever is later, provided, however, that a qualified individual who has received wages with respect to regular employment after he attained the age of 65 shall receive an annuity reduced, for each calendar month in any part of which such regular employment occurred, by an amount equal to one month's benefit.
- (c) The monthly annuity shall consist of:
 - One-half of 1% of the first \$3,000 of total wages,
 - plus
 - One-twelfth of 1% of the next \$42,000 of total wages,
 - plus
 - One-twenty-fourth of 1% of the excess of total wages over \$45,000,
 - but
 - subject to a maximum of \$85 per month.
- (d) The "wages" on the basis of which benefits are determined consist of all remuneration for employment after December 31, 1936, and before attainment of age 65, including the cash value of all remuneration paid in any medium other than cash. However, only that part of the remuneration which does not exceed \$3,000 in any one calendar year, received from any one employer, is considered in determining the benefits.
- (e) Wages received by individuals while in one of the excluded classifications set forth in (6) above are not considered in determining the benefits.

Death Benefits

Death benefits are payable as follows:

- (a) If an individual dies before attaining age 65, there shall be paid to his estate an amount equal to $3\frac{1}{2}\%$ of his total wages, as defined in (7) (d) and (e) above.
- (b) If an individual dies after having attained age 65, there shall be paid to his estate the excess, if any, of $3\frac{1}{2}\%$ of his total wages as defined in (7) (d) and (e) above, over the amount, if any, paid to him under Title II of the Act during his life.

Lump Sum Payment

If an individual has not qualified for an annuity under the terms of (7) (a) above upon attaining age 65, he will receive in a lump sum an amount equal to $3\frac{1}{2}\%$ of his total wages as defined in (7) (d) and (e) above.

		Monthly Annuity Based on Level Monthly				
Present		Wage of				
Age	Years of Contribution	\$50	\$100	\$150	\$200	\$250
60	5	\$15.00	\$17.50	\$20.00	\$22.50	\$25.00
55	10	17.50	22.50	27.50	32.50	37.50
50	15	20.00	27.50	35.00	42.50	50.00
45	20	22.50	32.50	42.50	51.25	56.25
40	25	25.00	37.50	50.00	56.25	62.50
35	30	27.50	42.50	53.75	61.25	68.75
30	35	30.00	47.50	57.50	66.25	75.00
25	40	32.50	51.25	61.25	71.25	81.25
20	45	35.00	53.75	65.00	76.25	85.00

Old-Age Reserve Account

An Old-Age Reserve Account is created in the Treasury of the United States, and there is authorized to be appropriated annually to this Account an amount sufficient as an annual premium to provide for the payments required under Title II, such amount to be determined on a reserve basis in accordance with accepted actuarial principles and based upon such tables of mortality as the Secretary of the Treasury shall from time to time adopt and upon an interest rate of 3% compounded annually. Such amounts as are not required to meet current payments shall be invested in obligations of the United States or in obligations guaranteed as to both principal and interest by the United States, and such obligations shall bear an effective interest rate of at least 3%.

Payment of Benefits

The Social Security Board shall from time to time certify to the Secretary of the Treasury the name and other relevant facts with respect to each individual entitled to receive a payment under Title II and the Secretary shall make such payments.

UNEMPLOYMENT COMPENSATION AND PAYROLL TAXES THEREFOR

In addition to the federal taxes described above, employees are subject to another tax imposed by the Indiana Unemployment Compensation law. This state law requires the company to deduct an amount from each employee's paycheck every payday.

"Every employer shall, notwithstanding any provisions of law in this state to the contrary withhold in trust the amount of his employees' contributions from their wages at the time such wages are paid, shall show such deductions on his payroll records and shall transmit all such contributions to the State Treasurer

in such manner and at such times as the Board may prescribe." Chapter 4, Acts of 1936, Section 4(c)3.

The rate of contribution by employees is fixed at 50% of the rate at which the company is required to pay, but the employee rate cannot exceed 1% at any time. For 1937, the rate on employees is .9%, or \$9.00 per \$1,000.00 of wages.

The company has been paying at the rate of 1.2% of its payroll since April 1, 1936, and will pay 1.8% during 1937. During 1938 the company rate is 2.7% of the payroll and may later increase to 3.7%, with .3% payable to the Federal Government presumably for administrative purposes.

The unemployment benefit provisions are quite detailed and difficult to describe. Mr. Jackson promises to send display cards at some later time showing the benefits in detail. It may be said now, however, that they are at the rate of $\frac{1}{2}$ of each employee's full time weekly wages (as determined by law) but not more than \$15.00 nor less than either \$5.00 per week or $\frac{3}{4}$ of full-time weekly wages, whichever is the lesser. Duration of weekly benefits varies with previous employment but is not to be longer than 15 weeks. No unemployment compensation will be paid until after April 1, 1938.

SUMMARY

Total payroll taxes on you as an employee may eventually (after 1938) run as high as 4% and on the Company as an employer as high as 7%, or a total payroll tax of 11%. If your average pay is \$20.00 a week, your tax contribution would be 80c each week, or \$41.60 a year, assuming you have full-time employment. To this the Company would have to add its tax contribution of 7%, so that the total payments by you and by the Company on your wages would be \$114.40 for a year.

The minimum possible payroll taxes after 1938 will be 3% on you as an employee and 3.3% on the Company as an employer. Based on the same assumptions as in the foregoing paragraph, your tax contribution would be 60c a week, or \$31.20 a year. The Company's tax contribution on your behalf would be 66c a week, or \$34.32 a year, or a total payroll tax on your wages of \$65.52.

The difference between maximum and minimum taxation rates is due to the provisions of the State Unemployment Compensation Act. Under it, it will be to the advantage of everyone in the Duncan organization to stabilize the working force as much as practicable. This we have endeavored to do in the past and we will continue to make the same endeavor in the future. Most authorities seem to feel, however, that very few manufacturing concerns will be able to stabilize employment sufficiently to reach the minimum rates. Our present plan is to work 45 hours a week when business is particularly good, to consider 40 hours as a normal week, and to go to 36 hours only when business is slack. It must be realized that in order to maintain a balanced production, it is sometimes necessary to make individual layoffs even when there is no general change in hours. As in the past, in making layoffs, we will consider both merit and length of service, and also in some cases number of dependents. It is our sincere hope that our business will continue good and permit us to maintain present schedules for a long time to come.

In exchange for these payroll taxes you will presumably secure advantages as outlined above in the form of unemployment compensation and old age benefits. Some of the advocates of these measures point out that these payroll taxes are not actually a deduction from your earnings but merely a postponement, since eventually and on the average you will receive the entire amounts, except for the cost of Government administration and supervision.

Your foreman will be glad to assist you in obtaining further information on these payroll taxes and benefits. In case he fails to secure an answer to your

questions in a reasonable length of time, I shall be glad to answer them myself to the best of my ability, if you will let me know.

Both the Republican and Democratic candidates advocate some form of old age benefits and some form of unemployment compensation. It is not the purpose of this letter to attempt to influence your vote, nor to give the views of various candidates, but only to call this problem to your attention. The views of the principal presidential candidates are set forth in newspapers and on the radio.

It is my understanding that shortly after election we will all be asked to register at the local Post Office where each will be given a number and record will be made of place of birth, certain family connections, and physical description.

As bulletins are issued by the Federal and State Governments, they will be posted on our bulletin boards or distributed to you individually.

FRED HOLMES
President

NOTICE TO EMPLOYEES (AS SUGGESTED BY MR. JACKSON)

REGARDING

UNEMPLOYMENT COMPENSATION AND OLD AGE BENEFITS

Provisions of the Federal Social Security Act and its companion measure, the Indiana Unemployment Compensation Law, will begin to affect our employees January 1, 1937. Therefore, we are presenting the following explanation of this program, which is divided into two parts:

(1) *Unemployment Compensation*

Since April 1, 1936, this company has paid to the Indiana Unemployment Compensation Fund 1.2% of its payroll. *Beginning January 1, 1937, the company is required by law to deduct from your wages .9 of 1% for payment to the unemployment fund* and in addition the company itself will pay 1.8%.

Rates of contribution to the State unemployment fund will be 1% for employees in 1938 and 1939, and by law may never be more than 1%. The company rate rises to 2.7% for 1938 and 1939. After 1939, if our employment is sufficiently stable, State contribution rates for both the company and its employees may be reduced and even eliminated. (See table at bottom of this notice.)

Money paid in this manner is used solely to build up a fund from which benefits will be paid to eligible employees after April 1, 1938, in event of unemployment.

The company also pays under the Federal provisions regarding unemployment a Federal excise tax of approximately .1 of 1% based on 1936 pay rolls, .2 of 1% for 1937, and .3 of 1% for 1938.

(2) *Old Age Benefits*

Both the company and the employee will also contribute under Old Age Benefits provisions of the Federal Social Security Act. *Beginning January 1, 1937, the company will pay 1% and will be required to deduct 1% from the wages of each employee for this purpose.* Rates for future years are listed at bottom of this notice. Under this plan, employees reaching the age of 65 after 1942 will receive monthly annuities ranging from \$10 to \$85 based on the amount of wages on which Old Age Benefits contributions have been made. In event of death, the employee's estate will receive a lump sum payment.

THE JOHN DOE COMPANY

PAYROLL RATES FOR UNEMPLOYMENT COMPENSATION AND OLD AGE BENEFITS

UNEMPLOYMENT COMPENSATION

State Rates	
Em- ployer	Em- ployee
1936	1.2% None
1937	1.8% .9 of 1%
1938	2.7% 1%
1939*	2.7% 1%

* After December 31, 1939, the rates of employers and employees depend on the condition of the employers unemployment reserve account. If employment is stabilized, it is possible to reduce or eliminate contributions from both employer and employee.

Federal Rates *

	Em- ployer	Em- ployee
1936	.1 of 1%	None
1937	.2 of 1%	None
1938	.3 of 1%	None
1939	.3 of 1%	None

* These rates are approximate, being 1/10 of the actual Federal Tax. To receive these rates, however, the employer must have paid proper contributions to the State Unemployment Fund before the Federal tax is due.

OLD AGE BENEFITS

Administered by Federal Government Exclusively

	Em- ployer	Em- ployee
1937, '38, '39 ...	1 %	1 %
1940, '41, '42 ...	1½ %	1½ %
1943, '44, '45 ...	2 %	2 %
1946, '47, '48 ...	2½ %	2½ %
After 1948	3 %	3 %

No payments required on wages in excess of \$3,000 per year.

Note: This law has no connection with Old Age Pensions (known in the Federal Act as Old Age Assistance). Old Age Pensions are paid only to needy persons through the respective County Welfare Boards from funds provided as follows: 50% by the Federal Government, 30% by the State Government, and 20% by the local County.

APPENDIX D

STATE UNEMPLOYMENT-INSURANCE LAWS¹

Of the 44 State legislatures in regular session this year, New York, Utah, and Washington have passed unemployment-insurance laws. The three acts were for the most part drafted to take advantage of the proposed Federal economic security measure. A fourth act in Wisconsin has already been put into operation, and benefits are payable July 1, 1935.

There are two main types of unemployment-insurance acts—i.e., providing for a pooled fund, and providing for individual reserve accounts.

New York and Washington have adopted the "pooled fund" type. All contributions are paid into a single undivided fund from which benefits are paid to all eligible employees.

Wisconsin, in its act passed in 1932, established an unemployment reserve fund which has in part been followed by the legislature of Utah. Under this type of law, contributions to the fund are segregated into separate employer's accounts. The benefit liability of each employer's account is limited to the employees of that particular employer. After sufficient actuarial data have been collected, each employer's rate of contribution will vary according to his benefit experience. In this way the reserves plan is expected to operate as a stabilizer of employment.

Summaries of the two unemployment-insurance laws follow:

New York

Coverage.—Employees of establishments having 4 or more employees. Excludes nonmanual workers with salaries of more than \$2,500 a year or more than \$50 a week; farm laborers; spouse or minor child of the employer; workers in nonprofit organizations operated for religious, scientific, charitable, or educational purposes. An employer not otherwise subject to the act may elect to become subject to it.

Contributions.—Payable by each employer subject to the act, on and after January 1, 1936. Contributions are at the rate of 3 percent of the pay roll, except that during 1936 the rate is to be 1 percent and during 1937, 2 percent. No agreement by an employee to pay any part of the contribution shall be valid and no employer shall make a deduction for such a purpose.

Benefits.—Fifty percent of full-time weekly wages, but not to exceed \$15 per week, nor be less than \$5 per week.

Duration of benefits.—Payable in the ratio of 1 week of benefit for each 15 days of employment within the 52 weeks preceding the beginning of the payment of benefits. The total amount of benefits to which an employee shall be entitled in any consecutive 52 weeks shall not exceed 16 times his benefit for 1 week of total unemployment.

Eligibility.—To be entitled to benefits an employee must have had 90 days of employment within the preceding 12 months or 130 days of employment in the preceding 24 months. He must be able to work and willing to accept employment for which he is reasonably fitted, but is not disqualified for refusing to accept employment which would require him to join a company union or interfere with his joining or retaining membership in any labor organization. He is not required

¹ Reprinted in part from the *Monthly Labor Review*, May, 1935, Vol. 40, No. 5, pp. 1195 et seq.

to accept work in an establishment in which there is a strike or industrial controversy, or where the wages, hours, and conditions of employment are substantially less favorable than those prevailing for similar work in the locality, or where the employment is a great distance from his home.

Waiting period.—No benefits are to be paid until a waiting period of 3 weeks has elapsed, but not more than 5 weeks of unemployment for which no benefit is paid shall be required as a waiting period within any calendar year. The waiting period is extended to 10 weeks in cases in which either an industrial controversy or the worker's misconduct in connection with his employment results in loss of employment.

Seasonal industries.—In industries not operating more than 18 weeks in a year and employing persons not ordinarily employed in other employments for hire, the commissioner shall determine the seasonal period for the industry, the right to benefit, and the conditions required for the payment of the benefit so that such persons will receive benefits in reasonable proportion to the length of time worked in such industry.

Unemployment insurance fund.—The fund is to be administered in trust and used solely to pay benefits. All contributions paid are to be deposited in or invested in the obligations of the "unemployment trust fund" of the United States Government. An unemployment administration fund is created, to be used for administration of the act. To provide for the establishment and administration of public employment offices, an employment service account is maintained as part of the unemployment administration fund.

Administration.—A commissioner administers the system. A State advisory council of 9 members appointed by the governor is also established, 3 as representatives of employers, 3 of employees, and 3 of the public. Their powers are advisory and investigatory. The council must report by March 1, 1939, as to the practicability of adjusting contributions with respect to the hazards of unemployment in various establishments.

Claims.—Claims for benefits shall be filed at the local State employment offices where workers register as unemployed. Within 10 days after a decision of the manager of a local employment office, a dissatisfied party can appeal to an appeal board of 3 members, appointed by the governor. Further appeal, limited to questions of law, may be made to the courts.

Effective date.—The act provides that it shall take effect immediately. Payment of benefits is to begin January 1, 1938.

The act was approved by the Governor on April 25, 1935.

Wisconsin

Coverage.—Employees in establishments employing 10 or more persons. The act excludes farm laborers, domestic servants, relief workers, elected and appointed public officers, workers in the logging industry, interstate railroad employees, school teachers, and registered part-time workers.

Contributions.—Employers contribute 2 percent of pay roll to the unemployment reserve fund and 0.2 percent to the administration fund. After a reserve of \$55 per worker is accumulated, the employers contribute 1 percent until the reserves amount to \$75 per worker, when contributions are suspended until the reserve falls below \$75 per employee. Any agreement by an employee to contribute is void, and employers are forbidden to make deductions from wages for this purpose.

Employers who guarantee 42 weeks of employment in a year, at the rate of at least two-thirds of the full-time weekly hours, are exempted from the payment of the regular contributions to the reserve fund.

Benefits.—For total unemployment, an employee is entitled to \$10 per week

or 50 percent of his average weekly wage, whichever is lower, but not less than \$5 per week. For partial unemployment, the benefits are the difference between the employee's actual wages for the week and the weekly benefit to which he would be entitled if totally unemployed. The employer's account is liable for benefits in the ratio of 1 week of total unemployment benefit to each 4 weeks of employment. The liability of the account is dependent upon the resources in the account at the beginning of the month. In case the amount in the employer's account is insufficient to meet the payments provided for in the act, the benefits are reduced. When an employee is employed by more than one employer within any 12-month period, the payment of benefits is made from the successive employers' accounts in inverse order to such successive employments.

Duration of benefits.—Benefits are payable for not more than 10 weeks in any 1 year.

Eligibility.—To be eligible for benefits an employee must be willing and physically able to work; and have been a resident of Wisconsin for 2 years or have been gainfully employed for 40 weeks within the preceding 2-year period. In order to obtain benefits from an employer's account, the worker must have been employed by him for at least 4 weeks. No benefits are to be paid if the employee received in wages during the 12 months preceding unemployment \$1,500 or more, or if he has lost his employment through misconduct, left it voluntarily without good cause, or because of an industrial dispute still in active progress in the establishment in which he was last employed. Benefits are not withheld, however, because of refusal to accept employment available because of an industrial dispute or to accept work in an establishment where the wages, hours, or conditions of employment are not those prevailing for similar work in the locality.

Waiting period.—No benefits are paid until 2 weeks of total unemployment have elapsed, but not more than 2 weeks' waiting period per employer shall be required of any employee in any 52 consecutive weeks.

Unemployment reserve fund.—The fund is administered by the State. The act provides for a separate account for each employer contributing to the fund. No account shall be merged with that of any other employer except in cases in which the commission approves the pooling of accounts of two or more employers who desire to have joint accounts.

Administration.—The State industrial commission administers the act. It has the power to adopt and enforce rules and regulations to carry out the purposes of the law, and to establish as many free employment offices as it deems necessary. The commission also appoints advisory employment committees whose duty it is to assist the commission.

Claims.—Claims are made and payable through the superintendents of the public employment offices. Appeal from the superintendents' decisions may be taken to a board established in each employment office district. Decisions of these boards are reviewable by the commission or its representative. The decisions of the commission are subject to judicial review.

Effective date.—The voluntary features of the act became effective January 29, 1934, but the compulsory features were not operative until July 1, 1934, when contributions became payable. Benefits begin July 1, 1935.

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